THE GORGONACEA OF THE SIBOGA EXPEDITION

VIII. THE SCLERAXONIA

Siboga-Expeditie
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BY

C. C. NUTTING
Professor of Zoology, State University of Iowa

With 12 plates

(Aided by a grant from the ELIZABETH THOMPSON SCIENCE FUND)

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Section SCLERAXONIA Studer.
(= PSEUDAXONIA von Koch.)

Scleraxonia Studer. Versuch eines Systemes der Alcyonaria, 1888, p. 24.

The definition of this section of the Gorgonacea, as given by STUDER, is indicated in the following translation:

"Fixed, upright branched colonies in which the short polyp cavities are immersed in a canal-bearing cœnenchyma which contains numerous embedded spicules. The branches consist of a cortical substance containing the polyps and a medullary substance which contains spicules of different forms from those of the cœnenchyma, densely aggregated and either connected by a horny substance or bound together by a limestone substance into a stony axis in which the individual spicules are plainly evident".

This definition, although correct, may be considerably shortened without losing its effectiveness. Leaving out unessentials, the following will serve our purpose:

Gorgonacea with an axis in which the individual spicules can be recognized and in which they are connected into a more or less compact mass either by a horny substance or calcareous matter.

Although there is some intergradation between the Briareidæ on the one hand and the Gorgonellidæ, a holaxonian family, on the other; and although there is evident relationship between the Isidæ, another holaxonian family, and the Melitodidæ, this Section is of practical use in a treatment of the Gorgonacea and serves to segregate that great order into two groups which are fairly natural.

Family Briareidæ Gray.

Briaracées (in part) Milne Edwards et Haime. Histoire Naturelle des Coralliaires, 1857, p. 188.
Briareidæ Gray. Annals and Magazine of Natural History, Vol. IV, 1859, p. 443.
Briareidæ Verrill. Memoirs Boston Society of Natural History, I, 1863, p. 10.
Paragorgiaceæ Kölliker. Beiträge zur Kenntniss der Polypen, 1870, p. 11.
Briaridæ Studer. Versuch eines Systemes der Alcyonaria, 1887, p. 26.
Briareidæ Wright and Studer. Challenger Reports, the Alcyonaria, 1889, p. XXXI.
Briareidæ Bourne. A treatise on Zoology, part II, Chapter VI, 1900, p. 25.
Briareidæ Nutting. Alcyonaria of the Hawaiian Islands, 1908, p. 569.

Milne Edwards and Haime (1857) defined the "Briaracées" as follows:

"Polypieroide dont l'axe est occupé par un tissu subéreux ou spiculifère, ou par une cavité vide".

In accordance with this definition these writers included in the family the genera *Briareum*, *Solanderia*, *Paragorgia* and *Cœlogorgia*, the last of which, *Cœlogorgia* is not now regarded as belonging in the Scleraxonia.

Gray (1859) defines the family *Briareidæ* as follows:

"Coral arborescent, fleshy, supported by a central axis formed of numerous intertwined fusiform spicules". This writer includes but one genus, *Briareum*, in the family.

Verrill (1867—71) includes the genera *Briareum*, *Paragorgia*, *Titanidium* and, tentatively, his genus *Callipodium* which is not now regarded as belonging to the Gorgonacea at all.

Kölliker (1870) practically adopts the definition of Milne Edwards and Haime, but leaves off the last part "ou par une cavité vide", thus excluding *Cœlogorgia*. He divides the family into two sections, "Sympodidæ" with an encrusting cœnenchyme and "Paragorgiaceæ" in which the branched colony exhibits a differentiated cortical and nuclear portion or axis. This second section is practically identical with the *Briaraceæ* as at present accepted.

Studer (1887) offers a definition which has stood without essential modification until the present time, and a translation of which appeared in the Challenger Report, the Alcyonaria, 1889, as follows:

"Scleraxonia in which the cœnenchyma consists of a polyp-bearing cortex and a medullary substance of closely packed spicules; these are either developed on the surfaces of an upright shrubby colony, or the latter is relegated to the interior of a cylindrical stem over which is spread the former. In the latter case a more or less well-defined axis is formed which may be penetrated by nutritive canals, or may be quite without them".

The *Briareidæ* thus fall into two sub-divisions Briareinæ and Spongioderminæ.

All of the material of this family collected by the Siboga Expedition belongs to the subfamily Briareinæ. *Icilogorgia*, which has been placed by STUDER in the Spongioderminæ, has well-marked water-vascular canals in the axis and must therefore be included in the Briareinæ.

A definition which will sharply differentiate the family Briareidæ from Sclerogorgidæ, and at the same time give the necessary diagnostic features, is offered as follows:

Scleraxonia in which the spicules of the axis cylinder are either beset with distinct thorny points or wart-like verrucæ and are not possessed of horny sheaths by which they are agglutinated together either directly or by cross connections. Branches consisting of a cortex containing the calyces and an axis consisting of spicules closely packed in a matrix of connective tissue.

The amount of material collected by the Siboga Expedition and belonging to this family is hardly sufficient to justify a general discussion of the generic groups. The writer will therefore confine himself to a discussion of the genera represented.

Synoptic view of the genera and species of BRIAREIDÆ collected by the Siboga Expedition.

New species are indicated by an asterisk (*).

Solenocaulon.

Solenocaulon sterroklonium, *S. grayi*, *S. *querciformis*, *S. *jedanensis*.

Titanidium.

*Titanidium *friabilis*.

Semperina.

Semperina rubra, *S. *brunnea*.

Suberia.

Suberia köllikeri, *S. *excavata*, *S. *macrocalyx*.

Paragorgia.

Paragorgia splendens.

Iciligorgia.

Iciligorgia orientalis.

Systematic description of genera and species.

Genus **Solenocaulon** Gray.

Solenocaulon Gray. Annals and Magazine of Natural History, Series 3, Vol. X, 1862, p. 147.
Solenocaulon Genth. Zeitschrift f. wissenschaft. Zoologie, Bd. 17, 1867, p. 428.
Solenocaulon Studer. Monatsbericht der Königl. Akademie der Wissenschaften zu Berlin, 1878, p. 668.
Solenocaulon Wright and Studer. Challenger Reports, the Alcyonaria, 1889, p. XXXI.
Solenocaulon Brundin. Alcyonarien aus der Sammlung des Zool. Museums in Upsala, 1896, p. 12.
Solenocaulon Germanos. Gorgonaceen von Ternate, 1897, p. 145.
Solenocaulon Delage et Hérouard. Traité de Zoologie Concrète, II, 2, 1901, p. 412.
Solenocaulon Hickson. Alcyonaria of the Maldives, part I, 1903, p. 493.
Solenocaulon Thomson and Simpson. Alcyonaria of the Indian Ocean, II, 1909, p. 153.

GRAY (1862) gives a somewhat lengthy generic description accompanied by a good figure of the type species. His description is as follows:

"The coral coriaceous, tubular, circular, and simple below, compressed, subquadrangular, tortuous, and more or less branched above, the branches being similar in size and form to the main stem. The main stem and branches furnished with more or less elongate, subsolid, slender branches, which are placed on the edge of the large holes in the main stem and branches which communicate with the main tube. These branchlets, (and sometimes the branches at the base of them) are furnished with large cells for the polyps, which are placed in one (more frequently in two) series on each side of the branchlets. The polyp cells are rather large, circular, nearly superficial, and furnished with a cup divided into eight conical connivent lobes, each lobe being formed of some transverse spicules at the base and some obliquely-placed spicules diverging from each lateral edge toward the top above".

STUDER (1878) simply quotes the definition given above and, in 1887, gives a lengthy description which is translated in the Challenger Report (1889). This may be condensed as follows:

Colony with a flattened stem bearing polyps on its margins and one face. Cœnenchyma of two layers, cortical and medullary. Cortex with spicules varying from spindles to club-shaped; thick and polypiferous on one side of the axis, thin and barren on the other. The medullary portion has a very thin cortical layer and bears no polyps. Medullary mass consisting of closely approximated rod-like spicules united by horny material. Stem and branches inrolled on the side which does not bear polyps. It thus happens that in the stem and larger branches the margins will often touch so as to form a hollow tube, while the smaller twigs only exhibit a channeled stem.

GERMANOS (1897) discusses this genus at considerable length and divides it, very strangely, into two sub-genera on the basis of the presence or absence of a stem. The present writer agrees with HICKSON, and THOMSON and SIMPSON in regarding this division as unwarrented, especially as he (GERMANOS) includes *Solenocaulon tortuosum* in his subgenus Malacosolenocaulon, which is characterized as without a stem, when the figure given by GRAY in connection with his original description of that species shows an undoubted stem. GERMANOS added three new species to the genus, i. e. *Solenocaulon sterroklonium*, *S. diplocalyx* and *S. akalyx*.

HICKSON (1903) made a somewhat extended study of numerous specimens of this genus and concluded that *Solenocaulon tortuosum* Gray, *S. grayi* Studer, *S. tubulosa* Genth, and *Leucoella cervicornis* (Gray) all belong to the same species, *S. tortuosum*, and supports his thesis by what seems a somewhat labored argument regarding the action of parasitic or symbiotic crustaceans on the growth of these forms. He then adds a new species, *S. ramosa*, which seems to be established on much the same sort of characters as are the species which he discards.

THOMSON and SIMPSON (1909) recognized two valid species, *S. sterroklonium* and *S. tortuosum* among the specimens collected by the "Investigator" in the Indian Ocean. These writers also point out the inconsistency of HICKSON in establishing his species *S. ramosa* "when the only diagnostic feature seems to be the tunnel-like expansions".

The present writer feels that there is little gained by substituting such terms as sub-

species, varieties or "facies" for specific names, and is further of the opinion that it is impracticable to regard as "good species", in the Metazoa, those forms only which do not intergrade. The cœlenterata especially seem to be in such a plastic condition that extreme variation is common, and absolutely exclusive definition of species impracticable. In view of such conditions it seems best to regard a genus as simply a group of species more closely allied to each other than to other groups, and a species as a group of individuals more nearly allied to each other than to other similar groups, even if some degree of intergradation is shown.

The type species of this genus is *Solenocaulon tortuosum* Gray. Other species that have been described[1] are *Solenocaulon cervicornis* (Gray), *S. akalyx* Germanos, *S. diplocalyx* Germanos, *S. grayi* Studer, *S. sterroklonium* Germanos, ? *S. simplex*[2] Brundin, *S. tubulosum* Genth and the new species described in the following pages.

1. *Solenocaulon sterroklonium* Germanos.

Solenocaulon sterroklonium Germanos. Gorgonaceen von Ternate, 1897, p. 151.
Solenocaulon tortuosum (in part) Hickson. Alcyonaria of the Maldives, 1903, p. 495.
Solenocaulon tortuosum Thomson and Simpson. Alcyonaria of the Indian Ocean, II, 1909, p. 157.

Stat. 49ª. 8° 23′.5 S., 119° 4′.6 E. 69 meters. Coral and shells.
Stat. 80. 2° 25′ S., 117° 43′ E. From 50 to 40 meters. Fine coral sand.
Stat. 154. 4° 7′.2 N., 130° 25′.5 E. 83 meters. Grey muddy sand, shells, Lithothamnion.
Stat. 240. Banda Anchorage. 9 to 45 meters. Black sand, coral.
Stat. 273. Anchorage off Pulu Jedan, East coast of Aru Islands. 13 meters. Sand and shells.
Stat. 274. 5° 28′.2 S., 134° 53′.9 E. 57 meters. Sand and shells. Stones.
Stat. 282. 8° 25′.2 S., 127° 18′.4 E. 27—54 meters. Sand, coral and Lithothamnion.
Stat. 285. 8° 39′.1 S., 127° 4′.4 E. 34 meters. On the limit between mud and coral.
Stat. 318. 6° 36′.5 S., 114° 55′.5 E. 88 meters. Fine yellowish grey mud.
Stat. 319. 6° 16′.5 S., 114° 37′ E. 82 meters. Fine yellowish grey mud.
Stat. 320. 6° 5′ S., 114° 7′ E. 82 meters. Fine grey mud.

Colony plumiform, 40.5 cm. in height and with a spread of 3.7 cm. The stem is about 14 cm. long, flattened proximally and distally and round on other portions, basal expansion 1.1 cm. × 3 mm. in cross section, distal expansion semicircular in section, the flat face being anterior and about 7 mm. in diameter, and the round portion of stem 6 mm. in diameter. The upper part of the stalk appears to have born leaves which have dropped off. The branched part of the stem, corresponding to the rachis of pennatulids, bears a number of broad, usually opposite, greatly expanded leaves which bend around toward the front where they meet and coalesce, forming about 8 bands or girdles enclosing a tunnel-like passage along the front of the stem. These passages are inhabited by a macrouran crustacean, and vary from 9 to 17 mm. in width, measuring at their narrowest part in front. The branches give forth from their edges flattened branchlets which are narrow distally and become round in section, often measuring about 1 mm. in diameter. The distal part of the rachis is much flattened and ends in a frilled

[1] The present writer does not feel that he is in a position to decide on the validity of species of this genus which he has not had an opportunity to study.

[2] In the case of *Solenocaulon simplex* the writer has entertained a serious doubt as to the validity of the species because there is nothing either in the description or figure to separate it from other yonng species of the genus. See BRUNDIN, Alcyonarien aus der Sammlung des zoologischen Museums in Upsala, 1896, p. 9.

lobate expansion. The calyces are pretty evenly and regularly distributed along the edges of the leaves and their various expansions and processes, but there are also a few scattered ones on the anterior surfaces of the girdles.

The individual calyces are in the form of short cylinders when the polyp is expanded and, rounded domes when it is retracted. A typical one measures about 1.6 mm. high and 1.8 mm. broad. The calyx walls are filled with small spindles which are horizontally disposed basally and vertically disposed distally. The margin is ornamented with 8 angular points formed by the converging ends of spindles. The polyps are many of them well expanded, white in color, their walls with 8 series of horizontal spicules which are curved to fit the contour of the walls. Below the tentacle bases these spindles are arranged en chevron and rise in 8 points corresponding to those of the calyx margin; each point being composed of the distal ends of several spindles. The dorsal surface of each tentacle bears a symmetrical closely set double row of spindles arranged en chevron, but with their points directed toward the bases of the tentacles. There are 10 to 12 pairs of pinnules to each tentacle. A fully expanded polyp (in alcohol) measures 5 mm. in spread, across the tentacles.

There is a well-marked axis composed of a densely aggregated, felted mass of very slender needle-like or rod-like spindles with their surfaces ornamented with scattered thorny points. Mixed with these is a much less numerous form which is entirely different, being much larger, very stout, sometimes oval spindles with remarkably coarse and irregular verrucæ.

Spicules. These have been described. Those of the axis are remarkably slender, rod-like, comparatively smooth, but with scattered thorny points; and a few strikingly dissimilar oval or irregular spindles with coarse verrucæ. These two types are also found in the cœnenchyma of the branches; but here the larger spicules are slender, comparatively regular spindles with ordinary verrucæ. The cœnenchyma contains many of the irregular oval spindles found sparingly in the axis. There are also slender spindles in the calyces.

Color. The leaves are bright scarlet, the polyps white, the stem and rachis rather dull pink and the flattened basal part of stem very light pinkish or livid.

General distribution. Type locality. Ternate, also reported from the Maldives and the Indian Ocean.

This species is quite variable in color. Some of the specimens are white with pink calyces, and others are creamy white with brownish or salmon colored calyces. One young specimen from Station 319 is much like the colored figure of the original described by Germanos.

2. *Solenocaulon grayi* Studer.

Solenocaulon grayi Studer. Monatsbericht der Königl. Akademie der Wissenschaft. zu Berlin, 1878, p. 671.
Solenocaulon thomsoni (in part) Hickson. Alcyonaria of the Maldives, part I, 1903, p. 497.
? *Solenocaulon tortuosum* (in part) Thomson and Simpson. Alcyonaria of the Indian Ocean, II, 1909, p. 160.

Stat. 47. Bay of Bima, near South Fort. 55 meters. Mud with patches of fine coral sand.

Stat. 51. Madura Bay and other localities in the southern part of Molo Strait. 69 to 91 meters. Fine grey sand, coarse sand with shells and stones.
Stat. 114. 0° 58′.5 N., 122° 55′ E. 75 meters. Hard sand, very fine.
Stat. 117. 1° 0′.5 N., 122° 56′ E. 80 meters. Sand and coral.
Stat. 162. Between Loslos and Broken Islands, West coast of Salawatti. 18 meters. Coarse and fine sand with clay and shells.

Colony complete with the exception of the basal end of the stem, 44.5 cm. high. The stem is unbrached for 16 cm. of its length and its basal portion has been worn or cut away on one side so as to give it an appearance of being flattened although it is otherwise nearly round, 1 cm. in diameter, with a channel or groove on one side and a number or longitudinal irregular corrugations on its surface. The stem forks 16 cm. from its base into two rather unequal branches. One of these is gutter-shaped throughout, being convex on its dorsal and concave on its ventral aspect, with the exception of one "girdle" 1.5 cm. broad. The other, and larger, branch is solid and round in section for 6.5 cm. from the base, beyond which it is alternately guttered and partly girdled, the girdles in places being so extensive as to form long tunnels or arcades, in one case 4.1 cm. long. Both of the main branches give off numerous lateral branchlets which are greatly expanded basally and curve forward and then inward to meet and coalesce, thus forming the girdles or arcades. The branches bear many simple and a few compound branchlets alternately disposed. All of the ultimate branchlets are much flattened and more or less guttered, the guttering sometimes disappearing on the distal ends near which the twigs have a cross section of about 3.5 mm. × 1.7 mm.

The calyces are practically all lateral in position, being usually in fairly regular rows along the edges of the branches and branchlets. There are also a few groups of scattered calyces on the front surfaces of the girdles and arcades.

The individual calyces are very low conical verrucæ, a typical one measuring 1.2 mm. in height and 2 mm. in diameter at the base, and are from 2 to 3 mm. apart from centre to centre. Their walls are filled with vertically disposed spindles which tend to form 8 low marginal points which are much more evident than in *Solenocaulon sterroklonium*. The polyps are retractile, but in the specimen described stand as much as 2 mm. above the calyx margin. The basal part of the polyp body is armed with transverse spicules which higher up are en chevron and still higher lie in vertical bands, 8 of which surround the margin and encroach upon the tentacle bases. The distal parts of the tentacles are covered with a complete armature consisting of two series of delicate spicules with serrated edges, the series meeting on the mid-dorsal surfaces of the tentacles and extending obliquely forward, outward and downward, ending in a line with the bases of the pinnules. The polyp spicules are lighter and more jagged than those of *S. sterroklonium*, and the polyp seems more slender and delicate.

A cross section of a stem shows an outer layer of comparatively heavy and disk-like, sometimes almost globular, spicules covered with coarse verrucæ. The water-vascular canals are around the periphery of the axis and appear in section as regular oval openings. The axis is a felted mass of slender rod-like and needle-like spindles whose surfaces bear short thorny spines which are more prominent and numerous than in *S. sterroklonium*. The cœnenchyma of the branches is filled with rather slender spindles which intergrade on the one hand with rod-like

forms beset with thorny points, and on the other with typical spindles with ordinary verrucæ in regular whorls. A few true clubs are also seen, and an occasional branched spindle. Many of the slender spindles are bent in an arc, and some are doubly curved.

Color. The colony is a light tan brown, the polyps differing but little from the cœnenchyma.

General distribution. Type locality. Northwest Coast of Australia, 50 fathoms. This species is also reported from the Indian Ocean.

The writer finds himself unable to agree with the opinion expressed by HICKSON, and THOMSON and SIMPSON that this species is identical with *Solenocaulon tortuosum*. The absence of the Y-shaped spicules regarded by THOMSON as characteristic of *S. tortuosum* seems a good specific character. The basal part of the stem in the type specimen was missing, hence the oval spicules were not described by GRAY.

3. *Solenocaulon querciformis* new species. (Plate I, fig. 1, 1*a*; Plate XI, fig. 1).

Stat. 142. Anchorage off Laiwui, coast of Obi Major. 23 meters. Mud. (Young specimen).
Stat. 284. 8°43′.1 S., 127° 16′.7 E. 828 meters. Grey mud. (Type specimen).

Colony dendritic in form, but somewhat flabellate, 23.5 cm. in length. A stem 14 cm. long, found in the same bottle, appears to belong to the same specimen. If so, the colony was 37.5 cm. in length. The stem and all branches except the ends of the twigs are strongly flattened, the larger branches being coarsely and deeply furrowed lengthwise, but in a slightly spiral manner, these furrows being numerous and conspicuous. The stem measures 9.5 mm. × 7 mm. in section. The first branch is short and flat and soon coalesces with a larger one above it. A large branch is given off a little above the first and on the opposite side. This is much flattened, distorted and furrowed, and gives off numerous, usually lateral branchlets which are laterally expanded at their origins and are turtuous, like the branches of an oak tree, and sometimes give off branchings of the third order. The main stem gives off two other large branches which are greatly expanded laterally and also at the bases of the branchlets, and bear a series of unequal grooves and furrows at the front and back. The largest of these main branches is 9 mm. × 6 mm. in section near its base. After giving off these main branches the stem pursues an undulating course, giving off irregular lateral branches and breaking up at its distal end into a tuft of branchlets which re-divide until branchings of the 5th order are attained, the whole forming a clump of aggregated branchlets. The ultimate twigs are usually quite round in section, having a diameter of about 1.3 mm. The calyces are confined mostly to the smaller branches and twigs where they are usually lateral in position and rather distant, being about 3 mm. apart on the average.

The individual calyces are conical in form and vary greatly in size. A typical one measures 1.5 mm. in height and about the same in diameter. They are often slightly inclined toward the distal ends of the twigs. Their walls are filled with vertically disposed spindles. The polyps seem to be but partially retractile and most of them rest with their very heavy

collarets on the calyx margin. The collaret is composed of 8 to 10 rows of transverse spindles, the upper two or three rows curved, so that they form an en chevron arrangement on the tentacle bases. Still higher up on the basal part of the tentacles the spicules are arranged in longitudinal groups, one to each tentacle, each group forming a jagged point. Above these points the tentacles curve inward and their dorsal surfaces are armed with a double row of slender spindles, each row extending from near the mid-dorsal surface of a tentacle to near the pinnule bases.

A cross section of a stem shows a comparatively thin cœnenchyma with an ill-defined circlet of water-vascular canals around the periphery of the axis. The axis is composed of very slender rod-like or needle-like spindles with distant thorny points immersed in a horny matrix, and is penetrated with conspicuous water-vascular canals of irregular size.

Spicules. Those of the cœnenchyma of the stem are small, rounded, disk-like, or compact irregular forms with prominent and irregularly disposed verrucæ. Those in the axis are very slender rod-like forms which are smooth on the greater part of their surface, bearing distant thorny points and longitudinally disposed, forming a felted mass immersed in a horny matrix. The spicules of the cœnenchyma of the branches and of the calyx walls are mainly spindles of various forms, usually with irregularly disposed verrucæ. All intergradations between the forms described above are seen.

Color. The colony is light yellowish brown or tan color.

This species differs from all the others described in this genus in having all of the branches solid and without tunnels or belts inhabited by symbiotic crustaceans.

A label in the jar in which this specimen was found bears the word "*Spongioderma*"? In all essential characters, however, it seems to be a *Solenocaulon*. The axis is penetrated by conspicuous water-vascular canals, and this character would prevent its being placed in the "*Spongioderminæ*" of WRIGHT and STUDER.

Some fragments from station 142 are referred with doubt to this species. They are evidently from a young specimen. The stem and basal parts of branches are grooved and show a tendency to flattening. The calyces are rather distant and prominent. The polyps agree with the type in spiculation.

4. *Solenocaulon jedanensis* new species. (Plate II, figs. 1, 1*a*; Plate XI, fig. 2).

Stat. 164. 1°42'.5 S., 130°47'.5 E. 32 meters. Sand, small stones and shells.
Stat. 273. Anchorage off Pulu Jedan, East Coast of Aru Islands. 13 meters. Sand and shells. (Type locality).

Colony (base lacking) pinnate in general form, 16.5 cm. in height and with a spread of 4.8 cm. The main stem is oval in section, measuring 11 × 8 mm. 4.6 cm. above its proximal end it becomes tubular and gives off short tubular branches ending in small flattened, sometimes round, twigs. The tubular part of the main stem is compressed; but 9.4 cm. from its base it looses its tubular character and becomes alternately deeply channeled and belted, there being three belts about 1 cm. broad and three deeply channeled portions. The branches

tend to be lateral and alternate in position. They each have a short broad tubular basal part and each of these tubular parts bears a long projection from its distal end. These projections are sometimes lobular, sometimes narrow and flattened, and sometimes round in section. They are exceedingly irregular in disposition and are usually simple, but may bear short irregular branchlets. The calyces are born almost exclusively on these processes and are always lateral in position, where they are in one broken row, or two rows, on each side of twigs.

The individual calyces are almost entirely included, appearing as very low swellings with hardly appreciable height and a diameter of about 2 mm. Their apertures are surrounded by eight not very pronounced lobes filled with longitudinally disposed tuberculate spindles. The polyps are entirely retractile and in this specimen are withdrawn well below the margins, which close over them. They have their walls armed with curved transverse spindles below and spindles arranged en chevron towards the upper part and on the tentacle bases. Above this the tentacles are armed with longitudinal spindles, and their distal parts are bent abruptly inward and bear two rows of small spindles arranged en chevron and reaching to the bases of the pinnules.

A cross section of the stem shows the cœnenchyma filled with discs and rounded, heavily tuberculate spindles. The water-vascular canals are large and conspicuous, a number of them traversing the axis. The latter consists of a felted mass of slender rods and needles longitudinally disposed and bearing thorny points.

Spicules. These have already been partly described. Besides the slender forms in the axis there are oval and round, heavily warted spicules in the general cœnenchyma and the outer layer of calyx walls; and heavy, coarse tuberculate clubs and spindles of the inner wall of the calyces. Curved, moderately heavy spindles are abundant in the polyps, and much more slender and smaller ones in the tentacles. There are no Y-shaped forms.

Color. The colony is a rather light brown. Other specimens are darker brown.

This species seems distinct from the others, particularly in the spiculation of the calyx walls. It bears considerable resemblance to *Solenocaulon tortuosum*, but lacks the peculiar Y-shaped spicules which Thomson and Simpson regard as characteristic of this species[1]. Some of the specimens bear symbiotic brachyuran crabs, instead of the Macroura found in other species.

Genus **Semperina** Kölliker.

Semperina Kölliker. Beiträge zur Kenntniss der Polypen, 1870, p. 9.
Semperina Studer. Versuch eines Systemes der Alcyonaria, 1887, p. 28.
Semperina Wright and Studer. Challenger Reports, the Alcyonaria, 1889, p. xxxii.

In the original description of the genus *Semperina* Kölliker gives a detailed account of the species, *Semperina rubra* in which specific and generic characters are in no wise differentiated. A diagnosis can, however, be gathered from his analysis of the genera of his "Paragorgiaceæ" (pp. 11 and 12) as follows:

[1] Alcyonarians of the Indian Ocean, II, 1909, p. 155.

Colony branched, the stem and branches having well differentiated cortical and nuclear portions, the latter forming an axis which is penetrated by large water-vascular canals. Polyps only partially retractile. Stem cylindrical.

STUDER (1887) considers this genus to be closely related to *Solenocaulon* and defines it as shown in the following translation:

"But here the stem has a more cylindrical form and the nuclear mass withdraws more to the axis of the colony although it is always excentric and the polyps, as in the previous genus, are situated mainly on one side of the stem and branches".

This definition is repeated by WRIGHT and STUDER in their Challenger Report (1888) and is adopted for the present work.

The type and, up to the present time, the only known species of the genus is *Semperina rubra* Kölliker. One new species is added in the present work.

1. *Semperina rubra* Kölliker.

Semperina rubra Kölliker. Beiträge zur Kenntniss der Polypen, 1870, p. 9.

Stat. 258. Tual Anchorage, Kei Islands. 22 meters. Lithothamnion, sand and coral.

Colony incomplete, straggling in habit, 13.5 cm. in height. The main stem is hollowed, probably by some parasite or pathological condition, and probably flattened naturally, 2.3 cm. long to first forking and 1 cm. in greatest diameter. One of the main branches is simple, irregularly flattened, (a cross section near its base being 7 mm. × 4 mm.) and somewhat spirally twisted. The other main branch bears a number of very irregular mostly lateral branchlets projecting in an erratic manner from the main branch. One of the apparent branchlets is really a branchlet from a missing part of the colony which has anastomosed with the part secured. All of the branchlets are simple, most of them round in section and clavate at the ends. The calyces are distributed on three sides of the branches, with a marked tendency to aggregate in groups or clumps on one face of the branch or on the ends of the branchlets.

The individual calyces are almost entirely included in the cœnenchyma and appear as very low verrucæ about 2 mm. in diameter and with scarcely appreciable height. The polyps seem to be non-retractile, at least all are expanded in the specimen studied. They are very heavily spiculated, there being an unusually broad and heavy collaret of encrusting spindles which assume an en chevron arrangement just below the tentacle bases. The proximal part of the tentacles are covered with longitudinal spindles in several rows, and the distal parts are completely covered dorsally with spindles arranged in two series placed en chevron and reaching to the bases of the pinnules.

A cross section of a branch shows a rather thin cœnenchyma in which is embedded a regular circlet of water-vascular canals around the periphery of the axis. The axis is flattened and penetrated by a number of conspicuous water-vascular canals.

Spicules. These are exceedingly varied in form, but most of them are modifications of the simple spindle. The spindle forms range from excessively slender rods with smooth

surfaces or very distant thorn-like projections to proportionally very heavy and coarse spindles with surfaces covered with coarse, irregularly warty tubercles. There are also many oval spicules, such as are common in this family, true clubs and a few irregularly branched forms.

Rarely, girdled spindles and irregular crosses are seen, such as are figured by KÖLLIKER, the original describer of the species.

Color. The colony is a dark, rather deep red; the polyps yellowish and the spicules red and white.

General distribution. Type locality, "Bohol", KÖLLIKER.

Another specimen from the same station is pale in color and some of the polyps are completely retracted.

2. *Semperina brunnea* new species. (Plate II, figs. 2, 2*a*; Plate XI, fig. 3).

Stat. 273. Anchorage off Pulu Jedan. 13 meters. Sand and shells.
Stat. 164. 1°42'.5 S., 130°47'.5 E. 32 meters. Sand, small stones and shells.

The colony is branched, rudely flabellate in form, 20.5 cm. in height and with a spread of about 8 cm. The base is lacking. The main stem is approximately round in section, 4.8 cm. long to first branch, and 8 mm. in diameter. After giving off three stubs of branches it sends off a compound branch with four branchlets. 1.5 cm. above this it forks into two approximately equal branches each of which again branches dichotomously, one quite regularly so, until branchings of the 4th order are attained. All of the branches are round in section and more or less clavate at the ends. The main branches are about 5 mm. in diameter, the secondary branches about 4 mm., and the distal twigs 3 mm. At some of the furcations on the distal parts of the colony there is a membrane-like expansion or web of the cœnenchyma which fills in the angle sometimes as much as 8 mm. above the actual angle of the fork. The calyces are on three sides of the stem and branches, leaving the fourth side comparatively bare. On the other three sides the calyces are thickly and regularly implanted about 1.3 mm. apart.

The individual calyces are low dome-shaped verrucæ which vary greatly in height with the degree of expansion of the polyps. A typical one measures 2 mm. in diameter, and the upper parts of the walls are strongly 8-lobed and covered with coarsely tuberculate spindles and short oval forms. The polyps are completely retractile and very strongly spiculated. The collaret is composed of about 6 rows of encircling spindles which assume an en chevron arrangement on the tectacle bases. The distal part of each tentacle bears a strong band of longitudinal spindles which seem to encrust it to its tip.

Spicules. These are of the usual type for the genus. The axis bears relatively few long slender rod-like forms with distant spiny points, and relatively numerous strongly tuberculate spindles in which the tubercles are fairly distant on the slender forms and much crowded and irregular on the stouter forms. These intergrade with stout oval spindles covered with a compact mass of tubercles. The spicules of the cœnenchyma do not differ appreciably from those of the axis.

A cross section of the stem shows a not very well defined axis, a relatively thin cœnenchyma, a series of water-vascular canals around the axis, and few if any large canals penetrating the axis itself....

Color. The colony is a dark umber brown, lighter on the side devoid of polyps. A much larger specimen than the one described, from Station 273, is yellowish in color from a sponge which covers it, and the axis is penetrated by conspicuous water-vascular canals. A number of large dried specimens were also secured from the same station.

Genus **Suberia** Studer.

Suberia Studer. Monatsbericht der Königl. Akademie der Wissenschaften zu Berlin, 1878, p. 666.
Suberia Studer. Versuch eines Systemes der Alcyonaria, 1887, p. 28.
Suberia Wright and Studer. Challenger Reports, the Alcyonaria, 1889, p. XXXII.
Suberia Delage et Hérouard. Traité de Zoologie Concrète, II, 2, 1901, p. 413.

The original definition of this genus, as given by STUDER, may be translated as follows:

"Stem simple or branched, upright. Axis formed of not coalesced rod-like spicules immersed in a horny substance and without water-vascular canals. Cœnenchyma thick, containing thorny spindle-shaped spicules, Calyces large, standing at right angles from the stem, with an eight-rayed margin. Polyps with fine spindle-shaped spicules from the base to the tentacles. A circlet of longitudinal canals around the axis".

The same writer (1887) modified somewhat this definition as follows:

"In Suberia the nuclear mass is well defined and constitutes the axis of the cylindrical stems, which are slightly branched and bear polyps on all sides. Calyces aggregated, particularly on the club-shaped ends of the stems. The upper part of the polyp is retractile within a distinct calyx. A canal system of relatively large water-vascular canals penetrates the axis".

WRIGHT and STUDER (1889) give a translation of the original definition of STUDER; but STUDER's later definition, just quoted, seems preferable.

Suberia köllikeri Studer is the type of this genus. Other known species are *Suberia clavata* Studer, *S. genthi* Wright and Studer and the new species in the Siboga collection.

1. *Suberia köllikeri* Studer.

Suberia köllikeri Studer. Monatsbericht der Königl. Akad. der Wissenschaften zu Berlin, 1878, p. 667.

Stat. 297. 10° 39′ S., 123° 40′ E. 520 meters. Soft grey mud with brown upper layer.

Colony incomplete, consisting of a central stem and five laterally disposed branches. Length 20.3 cm. The main stem is round, varying from 6 mm. to 3.5 cm. in diameter, the latter measurement being taken near the middle of the colony. There are several knob-like swellings on the stem that may indicate new branch origins. There are three branches on one side and two on the other, all being simple except one which is forked. They vary from 1.5 cm. to 7.3 cm. in length and are about 3 mm. in diameter, except at the clavate ends which are 7.3 mm. across. These enlarged ends remind one of the genus *Paragorgia*. The calyces are

irregularly distributed on all sides of the colony, being somewhat more numerous on the sides of the stem and branches and most closely aggregated on the club-like branch terminations. They vary from 3.3 mm. to 7 mm. from summit to summit.

The individual calyces are low but evident verrucæ varying greatly in size. A typical one measures 1.3 mm. in height and 3.5 mm. in diameter. There are eight sharply defined marginal lobes which close over the retracted polyps, the slit-like spaces between the lobes forming an eight-rayed star. The walls of the calyces, like the general cœnenchyma, are filled with oval, densely tuberculate spicules. The polyps are completely retractile and the dorsal surfaces of the tentacles are completely encrusted with oval, very tuberculate spicules.

A transverse section of a branch shows a comparatively thin cœnenchyma in which is a very regular series of many water-vascular canals. The axis is spongy in texture and filled with a felted mass of rather long, slender, rod-like or needle-like spindles with their surfaces ornamented with rather distant thorny points. The axis is penetrated with numerous canals of various sizes.

Spicules. The spicules are of two main types. 1st the rod-like thorny spindles of the axis. These are not so delicate as in *Solenocaulon*, and the thorns are comparatively larger. Many are spindle-shaped rather than rod-like. The second type is a minute, oval, sometimes round spicule with very prominent verrucæ which are usually arranged in symmetrical whorls and also cap the ends. Commonly there are two such whorls and two caps. Nearly all of the spicules are one or the other of these two types, or easily recognizable modifications of them.

Color. The specimen is creamy white throughout.

General distribution. Type locality. North of Three Kings Islands, North of New Zealand, 90 fathoms.

2. ? *Suberia excavata* new species. (Plate III, figs. 2, 2*a*; Plate XI, fig. 4).

Stat. 142. Anchorage off Laiwui, coast of Obi Major. 23 meters. Mud.

Specimens in a very fragmentary condition. The one described is a part of a branch 3.9 cm. long and with a diameter of 8 mm. approximately round in section. The surface is almost covered with papilliform calyces resembling those of *Eunicea*.

The individual calyces are club-shaped, pointed obliquely upward and outward, averaging about 3.5 mm. long and 1.8 mm. in diameter near the distal end. They are adnate to the branch throughout their length and their margins terminate is 8 not very conspicuous lobes which are tightly closed over the retracted polyps. The calyx walls are filled with regular spindles disposed longitudinally. The polyps are entirely retractile and appear to be devoid of spicules.

A cross section of a branch shows a rather thin cœnenchyma and an axis cylinder composed of purple and deep violet spicules embedded in a horny matrix. The axis is hollow throughout the length of all of the fragments, having a tunnel apparently made by a small bivalve mollusk, one of which was found in situ. The tunnel is not round, but flat, to fit the mollusk, and the greater part of the axis has been absorbed or in some manner removed,

leaving but a thin wall of the substance of the axis which thus has a flattened section which may be due to the mollusk and not a natural character.

The water-vascular canals are mostly arranged around the axis, but some of them penetrate the latter.

Spicules. Those of the axis are deep purple in color and are large strong spindles with narrow very regular whorls of blunt spines and warts. There are also triradiate forms, Y-shaped spicules and irregularly branched forms, all larger than is common in this genus. The spicules of the cœnenchyma are colorless and of much the same shape as those in the axis, spindles with numerous whorls of verrucæ being by far the most common forms, although the others are not lacking.

Color. The colony is very light yellowish brown, the axis deep purple and the polyps, or at least the tentacles, yellow.

This is the first instance in which the writer has seen a mollusk apparently living a symbiotic life in the interior of the axis cylinder of a gorgonian.

3. *Suberia macrocalyx* new species. (Plate III, figs. 3, 3*a*; Plate XI, fig. 5).

Stat. 122. 1° 58′.5 N., 125° 9′.5 E. 1264—1165 meters. Stone.

Specimen incomplete, consisting of an erect stem with short scattered branches. Length 13.5 cm. The stem and branches are round, the former 3 mm. in diameter. The first branch arises 2.6 cm. from the basal end of the stem and is simple. There are six other short simple branches irregularly disposed on all sides of the stem. Three of these, and the stem termination, end in definite swellings bearing each a clump of calyces. The calyces are irregularly distributed on three sides of the proximal parts of the stem and branches and on all sides of the distal parts of the colony. They are about 3 mm. apart on the proximal parts of the specimen and more closely approximated on the terminal twigs, where they form definite clumps or clusters with the individual calyces averaging about 1.5 mm. apart.

The individual calyces are long, tubular and project at right angles from the branches. A typical one measures 1.8 mm. in height and 2 mm. in diameter. The calyx walls are filled with long thorny spindles arranged en chevron, especially on the upper parts where they rise into eight angular points around the margin. The polyps are retractile, but usually rest (in the type) with their collarets just above the calyx margins. The collaret is very strong, consisting of several closely set rows of transverse spindles arranged en chevron over the tentacle bases, where they project in definite points. Beyond this the tentacles have their dorsal surfaces armed with longitudinally placed spindles.

A cross section of the stem shows a rather thin cœnenchyma filled with slender longitudinal spindles, a not very well defined series of water-vascular canals around the axis and an axis composed of a felted mass of slender thorny spindles and penetrated by conspicuous water-vascular canals.

Spicules. These are all slender spindles differing mainly in the number of thorn-like

points scattered over their surfaces. Some are almost smooth while others have the points thickly implanted over their surfaces. The spicules of the axis do not differ materially from those of the calyces and general cœnenchyma.

Color. The colony is very light yellowish brown, the polyps not differing in color from the stem and branches.

This specimen came from a greater depth than is often recorded for members of this family.

Genus **Paragorgia** Milne Edwards and Haime.

Paragorgia Milne Edwards et Haime. Histoire Naturelle des Coralliaires, I, 1857, p. 190.
Paragorgia Kölliker. Icones Histiologicæ, II, 1865, p. 141.
Paragorgia Kölliker. Beiträge zur Kenntniss der Polypen, 1870, p. 12.
Paragorgia Studer. Versuch eines Systemes der Alcyonaria, 1887, p. 28.
Paragorgia Wright and Studer. Challenger Reports, the Alcyonaria, 1889, p. XXXIII.
Paragorgia Delage et Hérouard. Traité de Zoologie Concrète, II, 2, 1901, p. 413.

The original description of this genus by Milne Edwards is as follows:

"Polypieroide arborescent, composed of a thin layer of cortical sclerenchyma in the thickness of which is limited the body cavities of the polyps, and a tubular (fistuleux) very large axis in the form of a spongy tissue very rich in calcareous spicules. Polyps united in groups on the extremities of the branches or upon the lateral tubercles, quite distant and irregularly disposed".

Kölliker (1865) confines himself to a definition of the spicules, and (in 1870) gives a sort of key to the genera of his "Briaracea" of which he makes a section "Paragorgiaceæ" characterized by a branched colony in which the branches show a distinct cortical and nuclear part (axis). The genus *Paragorgia* is characterized by the presence of large water-vascular canals in the axis, entirely retractile polyps and wart-like calyces irregularly distributed.

Studer (1887) gives a definition which can be adopted for our present purpose and is translated as follows:

"Colony upright, branched, branches cylindrical, with irregularly disposed warty calyces within which the polyps are retractile. The slightly differentiated axis contains large water-vascular canals. Besides the polyps there are, in *P. nodosa* Kor. and Dan., siphonozooids without tentacles".

The type species of this genus is *Paragorgia arborea*. Other species are *Paragorgia nodosa* Koren and Danielsen, *P. splendens* Thomson and Henderson and the new species secured by the Siboga Expedition.

1. *Paragorgia splendens* Thomson and Henderson. (Plate III, figs. 4, 4*a*).

Paragorgia splendens Thomson and Henderson. Alcyonarians of the Indian Ocean, Part I, 1906, p. 20.

Stat. 95. 5°43′.5 N., 119°40′ E. 522 meters. Stony bottom.

Two fragmentary specimens secured. The largest measures 2.3 cm. in height and has a spread equal to the height. The main stem, or branch in 3 mm. in diameter and bifurcates

4.5 mm. from its proximal end. One of the resultant branches gives off a single branchlet, and the other two, besides several nodules with groups of calyces as is characteristic of the genus. These nodules, as well as the single calyces, are all on three sides of the stem and branches, and are more closely crowded that in other species of the genus. The diameter of a terminal branch is 1.3 mm., while its swollen end is 5 mm.

The individual calyces are well marked, proportionally more prominent than in allied species and very unequally distributed. A typical calyx measures 1.3 mm. in height and 2 mm. in diameter. The margin is closed over the retracted polyp and bears eight rather feebly marked lobes. The calyx walls as well as the general cœnenchyma are covered with a superficial layer of small oval spicules. The polyps are completely retractile. There is a narrow but distinct band of red spindles on the dorsal surface of each tentacle, the bands becoming narrower and disappearing distally.

Zooids do not appear to be present in this species.

A section across a branch shows a poorly differentiated axis composed of rather slender tuberculate spindles and penetrated by water-vascular canals. There is a rather regular series of these canals surrounding the axis. The cœnenchyma is filled with stouter spindles intergrading with the oval densely tuberculate forms which constitute the superficial layer. There are also a few small crosses, stars, etc.

Spicules. These have already been described and consist almost exclusively of tuberculate spindles and densely tuberculate oval forms, with all degree of intergradation between them.

Color. The colony is a bright coral red throughout.

Genus **Iciligorgia** Duchassaing de Fontbressin.

Iciligorgia Duchassaing de Fontbressin. Revue des Zoophytes et des Spongiaires des Antilles, 1870, p. 12.
Iciligorgia Ridley. Zoological Collections of H. M. S. Alert, 1884, p. 351.
Iciligorgia Studer. Versuch eines Systemes der Alcyonaria, 1887, p. 29.
Iciligorgia Wright and Studer. Challenger Reports, the Alcyonaria, 1889, p. XXXIV.
Iciligorgia Delage et Hérouard. Traité de Zoologie Concrète, II, 2, 1901, p. 413.

The original definition for this genus is as follows:

"Axis mollis, spongiosus, spiculis farctus: cortex tenuis, spiculis aciniformibus formatus; calycibus mammæformibus, obtusis, in utroque latere ramorum uniseriatis".

Ridley (1884) defines the genus as follows:

"Central spicular axis dense, imperforate. Longitudinal canals forming a circumaxial zone. Erect, branched: stem and branches antero-laterally compressed, with knife-like lateral edges. Zooids wholly retractile, arranged in single series along each edge of the branches; no external verrucæ".

Studer (1887) defines the genus as seen in the following translation:

"Here the colony is in the form of an upright branched stem. Stem and branches compressed. Polyps borne in irregular rows on the thin borders of the branches, entirely retractile".

Wright and Studer (1889) give a somewhat more detailed description of the genus as follows:

"The colony is upright and branched; the stem and branches are compressed, irregular in section; the completely retractile polyps occur in a row within a groove along the sharp edge of the branches. The medullary mass forms an axis of spicules. It is close, but brittle in texture, not penetrated by, but surrounded by, longitudinal canals".

The only modification of this definition that the present writer would suggest is the omission of the last phrase. While it is true that the axis in many of the smaller branches is notpenetrated by the canals, it is also true that the large stem of the Siboga specimen about to be described is penetrated by perfectly evident, indeed conspicuous, water-vascular canals.

The type species of this genus is *Iciligorgia schrammi* Duchassaing. The only other known species is *Iciligorgia orientalis* Ridley.

1. *Iciligorgia orientalis* Ridley. (Plate IV, figs. 1, 1*a*).

Iciligorgia orientalis Ridley. Zoological Collections of H. M. S. "Alert", 1884, p. 351.

Stat. 273. Anchorage off Pulu Jedan, East coast of Aru Islands. 13 meters. Sand and shells.
Stat. 315. Anchorage east of Sailus Besar, Paternoster Islands. Up to 36 meters. Coral and Lithothamnion.

Colony incomplete, flabellate, profusely branched, 31 cm. in height and about 25 cm. in spread. Base missing. The main stem is irregular in section proximally, flattened higher up where it has a section of 8 × 12 mm. It gives off a branch 4.8 cm. from its proximal end. Almost immediately above this it forks into two main portions each of which again forks. Beyond this the branching is irregular, but there is a distinct tendency toward a unilateral arrangement of the ultimate twigs, and branchings of the 4th and 5th orders are attained. The ultimate twigs are long and slender, sometimes being as much as 17 cm. long. All of the branches and branchlets are more or less flattened, one of the main branches having a cross section of 11 × 7 cm. and an ultimate twig a section or 3.5 mm. × 2 mm.

The branches have a lateral sharply compressed edge or border, very strongly marked proximally and becoming practically obliterated on the distal parts. In the narrow edges of these ridges or borders there is a sharply impressed groove, like a knife cut, running along the sharp edges of all of the branches and twigs, although it is often practically obliterated by the closing of the adjacent cœnenchyma over the groove. In this groove the polyps are set in a single row on each side of the branches.

There are no calyces, except a few irregularly and sparsely scattered over isolated localities on what appears to be the back of the colony. These are low rounded verrucæ, sometimes round, sometimes oval, and showing indications of eight lobes around the margins. They can hardly be considered as normal. The polyps are completely retractile. There are a few curved spindles on the basal parts of the tentacles which show a tendency toward an en chevron arrangement.

A cross section of the stem shows a thin cœnenchyma filled mainly with oval coarsely

tuberculate spicules. There is a regular series of water-vascular canals immediately arround the axis and many others which conspicuously penetrate the axis. The axis is composed of a felted mass of slender rod-like or needle-like spicules, or spicules with distinct thorny points, or spindles with conspicuous irregular verrucæ.

A cross section of a twig shows a relatively thick cœnenchyma in which the polyps are embedded. Here the water-vascular canals do not seem to penetrate the axis.

Spicules. The cœnenchyma is filled with oval and coarsely tuberculate spicules the tubercles being so closely packed as to give a distinct resemblance to a morula, there being no appearance of definite whorls. The axis contains spicules of various forms, the rod-like or needle-like spindles with thorny points predominating. There are also true spindles with coarse irregular verrucæ, and oval forms like those in the cœnenchyma. There are all sorts of intergrading forms as well as an occasional cross, club or irregularly branched form.

Color. The colony is creamy white throughout. Other specimens, however, are tan-colored.

Other specimens from Station 273 are much larger than the one described. One of these is quite symmetrical, 41 cm. in height and with all of the terminal branchlets growing from the upper sides of branches. The color of this specimen is more decidedly a brownish yellow than any other of this species in the collection. Still another specimen shows a larger number of verruciform calyces on the flattened side of the colony. In places the lateral grooves in which the calyces are found, form a series of short definite slits, rather than a continuous groove.

It seems evident from a study of these specimens that *Iciligorgia* can not go into the sub-family Spongioderminæ; because the axis is conspicuously traversed by large water-vascular canals, while that sub-family is characterized by an axis which is not penetrated by these canals.

Genus **Titanidium** Agassiz.

Titanidium (Agassiz Manuscript) Verrill. Revision of the Polypi of the Eastern Coast of the United States. Memoirs Boston Society of Nat. Hist. I, 1863, p. 10.
Briareum Kölliker. Icones Histiologicæ, II, 2, 1865, p. 141.
Titanidium Studer. Versuch eines Systemes der Alcyonaria, 1887, p. 29.
Titanidium Kölliker. Beiträge zur Kenntniss der Polypen, 1870, p. 8.
Titanidium Wright and Studer. Challenger Reports, the Alcyonaria, 1889, p. XXXIII.

The original definition of this genus is as follows:

"Corallum irregularly dichotomous or simple; cœnenchyma rather thick, suberous, very spiculose, traversed by well-developed longitudinal ducts arranged in a single series around the axis. Cells disposed on all sides of the branches, not prominent. Axis perfectly distinct from the cœnenchyma, compact, but soft, cork-like, composed of closely united calcareous spicula".

Kölliker (1870) gives the following, which is a adopted in the present work:

"Axis moderately well defined, cortex of a single layer of hard sarcosome with minute canals. Polyps as in *Plexaura*, contained in pits in the cortex. Spicules 3—4—6 and 8-rayed with warty ends".

This author also gives the only good figure that I have seen of *Titanidium suberosum* (Ellis and Solander) the type and, up to the present time, the sole species of this genus.

1. *Titanidium friabilis* new species. (Plate III, figs. 1, 1*a*; Plate XI, fig. 6).

Stat. 304. Lamakera, Solor Island. 16 meters. Coral and sand.

Specimen dried and exceedingly brittle, as if made of soft chalk, 31 cm. in height.

Two large stems are coalesced shortly above their bases and are closely adherent for 8.3 cm. These and all of the branches are round in section, the larger stem being 1.5 cm. in diameter. One of these stems is broken off before branching and the other forms the remainder of the specimen. The stem curves strongly, becoming almost horizontal for .5 cm., after which it suddenly breaks up into a dense tuft of branches and branchlets which form a dense clump or cluster of numerous ultimate twigs. The stem also gives off a single straight branch where it separates from the other stem. This branch forks and one of the resultant branchlets subdivides several times and adds to the clump forming the distal end of the colony. Branchings of the 5th order are sometimes attained. The ultimate branchlets are not noticeably turgid at their ends and are usually about 4 mm. in diameter. The polyps are distributed on all sides of the branches much as in *Plexaura*, and the calyces are entirely included.

The individual calyces are indicated externally by their apertures alone. These are oval or slit-like according to the state of contraction of the polyps, and the slits are cut at various angles to the axis of the branch and are more abundant on the terminal than on the proximal parts of the colony. On the twigs they average a little more than 1 mm. apart and in places show a tendency to a linear arrangement. The character of the polyps can not be ascertained from the type, which is a dried specimen.

The axis is not well defined and is more friable than any other of this family that I have seen. The cœnenchyma is rather thin and the water-vascular canals form an irregular circlet around the axis.

Spicules. The spicules of the cœnenchyma are very densely tuberculate and short, sometimes oval, spindles, the tubercles usually entirely concealing the actual surface. While such forms as KÖLLIKER figures[1] for *Titanidium suberosum* can be found, they are not nearly so abundant as these densely and coarsely tuberculate spindles. In the axis there are a few slender forms with thorny verrucæ, approaching the characteristic spicules of the axis of *Solenocaulon*; but these are greatly outnumbered by the coarsely tuberculate spindles described above. Occasionally more slender spindles are seen, which may be younger spicules.

Color. The colony (dried) is creamy white. When immersed in alcohol it assumes a decidedly yellow color.

[1] Icones Histiologicæ, II, 2, plate XIX, figs. 19, 20 and 22.

DISTRIBUTION OF THE BRIAREIDÆ COLLECTED BY THE SIBOGA EXPEDITION

List of Stations

at which Briareidæ were collected by the Siboga Expedition
and a List of Species collected at each Station.

STATION 47. Bay of Bima, near South Fort. 55 meters. Mud, with patches of fine coral sand. *Solenocaulon grayi.*

STATION 49. 8° 20′.5 S., 119° 4′.5 E. 69 meters. Coral and shells. *Solenocaulon sterroklonium.*

STATION 51. Madura Bay and other localities in the southern part of Molo strait. From 69 to 91 meters. Fine grey sand; coarse sand with shells and stones. *Solenocaulon grayi.*

STATION 80. 2° 25′ S., 117° 43′ E. From 50 to 40 meters. Fine coral sand. *Solenocaulon sterroklonium.*

STATION 95. 5° 43′.5 N., 119° 40′ E. 522 meters. Stony bottom. *Paragorgia splendens.*

STATION 114. 0° 58′.5 N., 122° 55′ E. 75 meters. Hard sand, very fine. *Solenocaulon grayi.*

STATION 117. 1° 0′.5 N., 122° 56′ E. 80 meters Sand and coral. *Solenocaulon grayi.*

STATION 122. 1° 58′.5 N., 125° 0′.5 E. 1264—1165 meters. Stone. *Suberia macrocalyx.*

STATION 142. Anchorage off Laiwui, coast of Obi Major. 23 meters. Mud. *Solenocaulon querciformis, Suberia excavata.*

STATION 154. 0° 7′.2 N., 130° 25′.5 E. 83 meters. Grey muddy sand, shells and Lithothamnion. *Solenocaulon sterroklonium.*

STATION 162. Between Loslos and Broken Islands, West coast of Salawatti. 18 meters. Coarse and fine sand with clay and shells. *Solenocaulon grayi.*

STATION 164. 1° 42′.5 S., 130° 47′.5 E. 32 meters. Sand, small stones and shells. *Semperina brunnea, S. jedanensis.*

STATION 240. Banda Anchorage. 9 to 45 meters. Black sand. Coral. Lithothamnion bank in 18—36 meters. *Solenocaulon sterroklonium.*

STATION 258. Tual Anchorage, Kei Islands. 22 meters. Lithothamnion, sand and coral. *Semperina rubra.*

STATION 273. Anchorage off Pulu Jedan, East coast of Aru Islands. 13 meters. Sand and shells. *Solenocaulon sterroklonium, S. jedanensis, Semperina brunnea, Iciligorgia orientalis.*

STATION 274. 5° 28′.2 S., 134° 53′.9 E. 57 meters. Sand and shells, stones. *Solenocaulon sterroklonium.*

STATION 282. 8° 25′.2 S., 127° 18 .4 E. Sand, coral and Lithothamnion. *Solenocaulon sterroklonium.*

STATION 284. 8° 43′.1 S., 127° 16′.7 E. 828 meters. Grey mud. *Solenocaulon querciformis.*

STATION 285. 8° 39′.1 S., 127° 4′.4 E. 34 meters. On the limit between mud and coral. *Solenocaulon sterroklonium.*

STATION 297. 10° 39′ S., 123° 40′ E. 520 meters. Soft grey mud with brown upper layer. *Suberia köllikeri.*

STATION 304. Lamakera, Solor Island. 16 meters. Coral and sand. *Titanidium friabilis.*

STATION 315. Anchorage East of Sailus Besar, Paternoster Islands. Up to 36 meters. Coral and Lithothamnion. *Iciligorgia orientalis.*

STATION 318. 6° 36′.5 S., 114° 55′.5 E. 88 meters. Fine yellow grey mud. *Solenocaulon sterroklonium.*

STATION 319. 6° 16′.5 S., 114° 37′ E. 82 meters. Fine yellowish grey mud. *Solenocaulon sterroklonium.*

STATION 320. 6° 5′ S., 114° 7′ E. 82 meters. Fine grey mud. *Solenocaulon sterroklonium.*

This table shows that Briaridæ were secured at 25 of the Stations explored by the Siboga Expedition. Of the twelve species secured, seven were new. By far the most common species was *Solenocaulon sterroklonium* which was found at eleven Stations, ranging in depth from about 13 meters to 369 meters. The greatest depth at which a member of this family was secured was 1165 to 1264 meters where *Suberia macrocalyx* was dredged. Other comparatively deep-living species are *Solenocaulon querciformis*, from 828 meters; *Paragorgia splendens*, from 522 meters and *Suberia köllikeri*, from 520 meters.

All of the species are confined, so far as known, to the Indo-Pacific region. The distribution of the five species previously named being as follows:

Solenocaulon sterroklonium, Ternate, Indian Ocean.

Solenocaulon grayi, Northwest coast of Australia and Indian Ocean.

Semperina rubra, Bohol, Philippine Islands.

Suberia köllikeri, North of New Zealand.

Iciligorgia orientalis, Indian Ocean.

Family Sclerogorgidæ Kölliker.

Sclerogorgiaceæ (Subfamily) Kölliker. Icones Histiologicæ, II, 2, 1865, p. 142.
Suberogorgidæ Studer. Versuch eines Systemes der Alcyonaria, 1887, p. 29.
Sclerogorgiadæ Wright and Studer. Challenger Reports, the Alcyonaria, 1889, p. XXXIV.
Sclerogorgidæ Bourne. A treatise on Zoology, Part II, Chapter VI, 1900, p. 25.
Sclerogorgidæ Nutting. Hawaiian Alcyonaria, 1908, p. 569.

The original definition of this family is a follows:

"Gorgoniden mit ungegliederter Axe, die aus Hornsubstanz und verschmolzenen Kalkkörpern besteht. Cœnenchyma wie bei *Gorgonia*".

Studer (1887) amplifies this definition as the following translation shows:

"A plainly separable axis and horny substance which surrounds the thickly aggregated spicules. The axis is surrounded by water-vascular canals which communicate with the branched network of cœnenchymal canals which connect the polyps. The polyps show a warty exserted calyx into which the upper, tentacle-bearing part (of the polyp) can retract".

Wright and Studer (1889) give practically the same definition as the above.

The present writer would modify this definition so as to further emphasize the peculiar characters of the axis; as follows:

Scleraxonia with a well defined axis formed by an agglutinated mass of calcareous spicules which have surfaces devoid of verrucæ or of thorny points and are embodied in horny sheaths which often form a mesh or network by cross connection and adhesions.

This is a very well-defined family with only about a dozen known species. It is represented in the Siboga collection by two genera and eight species, three of which are new.

Synoptic view of the genera and species of Sclerogorgidæ collected by the Siboga Expedition.

New species are indicated by an asterisk (*).

Suberogorgia.

S. verriculata (Esper), *S. ornata* Thomson and Simpson, *S. köllikeri* Studer, *S. rubra* Thomson and Henderson, *S. *appressa*, *S. *thomsoni*, *S. *pulchra*.

Korœides.

K. koreni Wright and Studer.

Systematic description of genera and species.

Genus **Suberogorgia** Gray.

Suberogorgia Gray. Proceedings Zoological Society of London, 1857, p. 159.
Sclerogorgia Kölliker. Icones Histiologicæ, II, 2, 1865, p. 42.
Suberogorgia Studer. Versuch eines Systemes der Alcyonaria, 1887, p. 30.
Suberogorgia Wright and Studer. Challenger Reports, the Alcyonaria, 1889, p. xxv.
Suberogorgia Delage et Hérouard. Traité de Zoologie Concrète, II, 2, 1901, p. 413.

The original definition is not at present accessible to the writer, the above citation being from Wright and Studer (1889).

Kölliker (1865) defines his genus *Sclerogorgia* as follows:

"Kalkkörper des Cœnenchymes zahlreiche warzige gelbe oder farblose Spindeln 0,10—0,16 mm. lang, daneben auch einfachere Formen, die bei *Scl. verriculata* auch als Doppelrädchen mit zackigen Rändern erscheinen. Kalkkörper der Polypen kleine warzige Spindeln in gewöhnlicher Anordnung".

Studer (1887) claims that the name *Suberogorgia* has the priority for this genus, and defines it as shown in the following translation:

"Upright, branched, sometimes reticulate colonies with slightly exserted calyces which are situated mainly on the two sides of the slightly flattened stem and branches. The cœnenchyma is thick and shows longitudinal furrows on the bare surfaces. The spicules are warty spindles and double wheels".

Wright and Studer (1889) give practically the same definition, which will also serve the purpose of the present work.

The type of this genus is *Suberogorgia suberosa* (Esper). Other species are *S. köllikeri* Studer, *S. ornata* Thomson and Simpson, *S. patula* (Ellis and Solander), *S. rubra* Thomson and Hend., *S. suberosa* (Pallas), *S. verriculata* (Esper) and the new species in the Siboga collection.

1. *Suberogorgia verriculata* (Esper).

? *Gorgonia reticulata* E. and S. (Name only) Nat. Hist. of Zoophytes, 1786, p. 198.
Gorgonia verriculata Esper. Die Pflanzenthiere, II, 1794, p. 124.
Gorgonia verriculata Lamarck. Hist. Nat. Anim. sans Vert., 2me éd., 2, 1836, p. 489.
Gorgonella verriculata Valenciennes. Comptes rendus, XLI, 1855.
Rhipidigorgia verriculata Milne Edwards et Haime. Histoire Naturelle des Coralliaires, I, 1857, p. 176.
Sclerogorgia verriculata Kölliker. Icones Histiologicæ, II, 2, 1865, p. 142.
Rhipidella verticillata Gray. Annals and Magazine of Natural History, Ser. 4, Vol. V, 1870, p. 407.
Suberogorgia verriculata Wright and Studer. Challenger Reports, the Alcyonaria, 1889, p. 167.
Suberogorgia verriculata Thomson and Henderson. Alcyonaria of the Indian Ocean, II, 1909, p. 164.

Stat. 299. 10° 52'.4 S., 123° 1.1 E. 34 meters. Mud, coral and Lithothamnion.
Stat. 307. Ipih Bay, South coast of Flores. 27 meters. Volcanic sand.

Colony strictly flabellate and reticulate, base lacking. The height of the specimen is 26.5 cm. and the spread is about 19 cm. The main stem keeps its identity throughout, has

a rudely geniculate course, is round in section and has a diameter near base of 7.5 cm. From this main stem arise a few larger branches roughly alternating, and many smaller twigs. These anastomose very extensively, forming a close network the meshes of which vary greatly in size. The smaller twigs, forming the mesh, are round in section and have a rather uniform diameter of about 1.5 mm. The network extends clear to the periphery of the colony and the tips of the free twigs are not appreciably enlarged at the ends. The calyces are small and are distributed on all sides of the branches, but appear to be absent from the main stem and proximal parts of the larger branches. They are quite evenly distributed, averaging about 1 mm. from mouth to mouth.

The individual calyces are very low dome-shaped verrucæ, a typical one measuring about .7 mm. in diameter and showing eight distinct marginal lobes. The calyx walls are filled with minute round or oval spicules. When the polyp is entirely retracted the calyx is completely included. The polyps are minute, disk-shaped when retracted, and have their infolded tentacles armed with a dorsal series of longitudinally disposed spindles.

A cross section of a branch shows a moderate cœnenchyma and an axis composed of agglutinated spindles with smooth surfaces and a horny investment which coalesces freely with others. The axis is not penetrated by water-vascular canals, these being confined to a circlet in the cœnenchyma.

Spicules. As in other species of this genus these are of two sharply distinguished forms. 1st the long, often bent spindles with smooth surfaces and horny investment which coalesces to form the axis; and, 2nd, spindles varying from nearly round or oval forms to the typical terete spindle, and having their surfaces ornamented by regular verrucæ in well defined whorls. A few double wheels are also seen.

Color. The entire colony is a dull grayish brown.

General distribution. The type locality is not known; but was given, apparently at a guess, by Esper as the West Indies, which is extremely improbable. It is reported from the Northwest coast of Australia by Studer, and the Challenger secured it from the Hyalonema grounds, off Japan, 345 fathoms. A very large specimen from Station 307 measures 77.5 cm. in height and 52 cm. in diameter. The color of this specimen, which is dried, is earthy brown.

2. *Suberogorgia ornata* Thomson and Simpson.

Suberogorgia ornata Thomson and Simpson. Alcyonarians of the Indian Ocean. II, 1909, p. 164.

Stat. 81. Pulu Sebangkatan, Borneo Bank. 34 meters. Coral bottom and Lithothamnion.
Stat. 220. Anchorage off Pasir Pandjang, west coast of Binongka. 278 meters. Coral sand.
Stat. 257. Duroa Strait, Kei Islands. Up to 52 meters. Coral.

Colony flabellate and reticulate, 11 cm. in height and about 6.5 cm. in diameter. The stem and branches are not appreciably flattened and are without evident median grooves. The main stem grows from an encrusting base and is 2 mm. in diameter and 7.5 mm. long to the first branch. This branch extends outward and then upward, bears a number of lateral branches, one of which is compound, and is connected with the rest of the colony through

several anastomoses. Almost immediately above the first branch the main stem is rather abruptly bent to one side and gives off numerous lateral branches which are irregularly spaced and often compound and anastomose through their branchlets with other branches, forming a loose and irregular network of very delicate texture. Many of the branchlets are not more than .5 mm. in diameter, while the larger branches are scarcely 1 mm. thick. The calyces are irregularly but rather thickly distributed on all sides of the terminal twigs, and on three sides of the others. They average a little more than 1 mm. apart from summit to summit.

The individual calyces are small but prominent for the genus, being in the shape of a dome averaging about .8 mm. in height and 1.5 mm. in diameter at base. The margin is surrounded by eight lobes and the walls are provided with eight rather indefinite longitudinal ribs which are also seen in the general cœnenchyma as rude longitudinal corrugations resembling the bark of a tree. There is a superficial layer of small oval spicules and minute double heads in the calyx walls, beneath which are larger regular spindles. The polyps are completely retracted and much flattened or disk-shaped in retraction. They are provided with a rather weak collaret with the spindles arranged en chevron on tentacle bases. There are rather narrow longitudinal bands of spindles on the dorsal surfaces of the tentacles.

The axis is the typical one as described for the genus.

Spicules. These differ materially from other forms in this genus. There is a superficial incomplete layer of quite small double heads or dumb-bell-shaped forms under which is a much thicker layer of comparatively large spindles, often curved, with thick-set verrucæ arranged in regular whorls.

Color. The colony is a very light grayish brown.

General distribution. Type locality. Andaman Islands, Indian Ocean; also from the Laccadives. Although much more delicate that the type described by Thomson and Henderson, this form agrees well with that species. The describers speak of spicules which they call "double clubs", but their measurements show that they are double heads, as the term is used in the present work. "Stellate forms" would appear when double heads were viewed end on.

3. *Suberogorgia köllikeri* Wright and Studer.

Suberogorgia köllikeri Wright and Studer. Challenger Reports, the Alcyonaria, 1889, p. 167.
Suberogorgia köllikeri (var. *ceylonensis*) Thomson. Ceylon Pearl Oyster Report. Appendix to Alcyonaria, 1905, p. 171.
Suberogorgia köllikeri (var. *ceylonensis*) Thomson and Simpson. The Alcyonaria of the Indian Ocean, II, 1909, p. 164.

Stat. 164. 1°42′.5 S., 130°47′.5 E. 32 meters. Sand, small stones and shells.
Stat. 273. Anchorage off Pulu Jedan, East coast of Aru Islands. 13 meters. Sand and shells.
Stat. 274. 5°28′.2 S., 134°53′.9 E. 57 meters. Sand and shells. Stones.
Stat. 305. Mid Channel in Solor Straits, off Kampong Menanga. 113 meters. Stony.
Stat. 310. 8°30′ S., 119°7′.5 E. 73 meters. Sand with few pieces of dead coral.

Colony roughly flabellate in form, not reticulate, 14.5 cm. in height. The base is attached to a small dead coral. The main stem gives off a stub of a branch 1.6 cm. from its

proximal end, and a large compound outward and downward projecting branch 1.7 cm. above the stub. The stem is somewhat flattened, with a cross section of 3.5 mm. × 1.8 mm. The large branch bears unsymmetrically disposed branchlets, all from its upper side. Two of these branchlets are close together, nearly parallel, each with a single terminal twig and both considerably flattened. One of them has a cross section of 3.2 mm. × 1.8 mm. The part of the stem above the main branch already described bears two compound and four simple branches on its outer side. The stem and branches bear median grooves on front and back, and the twigs are flattened usually nearly to their tips. The calyces are mainly lateral in position, but there are a few on the front and back of the colony.

The individual calyces are prominent for this genus, dome-shaped, a typical one measuring 1.5 mm. in height and 2 mm. in diameter at the base. The walls are covered with short oval spicules and there is but a faint indication of marginal lobes. The polyps are completely retractile and show a feeble collaret and a few delicate longitudinally disposed spindles on the dorsal surface of the infolded tentacles.

A cross section of a branch reveals the structure common to the genus, except that the water-vascular canals may be more conspicuous than in other species in the Siboga collection.

Spicules. The cœnenchyma contains numerous spindles varying from almost round to terete in form. The tubercles are very large and closely crowded, but still are in regular whorls. In some cases girdled spindles are seen. The spicules of the axis are irregular, distorted forms with a heavy envelope and agglutinated into a sort of mesh. They bear no points or verrucæ.

Color. The colony is orange red, or red brown in color.

General distribution. Type locality. Hyalonema Grounds, off Japan, 345 fathoms. It has also been reported (as variety *ceylonensis*) from the Ceylon Seas and from the Andamans in the Indian Ocean.

4. *Suberogorgia rubra* Thomson and Henderson.

Suberogorgia rubra Thomson and Henderson. Ceylon Pearl Oyster Report. Appendix to the Alcyonaria, 1905, p. 172.

Stat. 133. Anchorage off Lirung, Salibabu Island. Up to 36 meters. Mud and hard sand.
Stat. 260. 5° 36′.5 S., 132° 55′.2 E. 90 meters. Sand, coral and shells.
Stat. 301. 10° 38′ S., 123° 25′.2 E. 22 meters. Mud, coral and Lithothamnion.

Colony flabellate, so profusely and finely branched as to give a false appearance of reticulation although anastomoses are few. Specimen 30.5 cm. high and with a spread of about 21 cm. The stem and branches are round in section and show but slight indications of the median grooves so common in this genus. The main stem is 4.5 mm. in diameter and tortuous in its course. 2.2 cm. from its base it sends off a large branch which is tortuous and gives off a number of lateral branchlets, 5 of which are compound. 3.7 cm. above this branch the main stem divides into two subequal parts, each of which bears numerous lateral branchlets some of which subdivide until brachings of the 6th order are reached. There is a tendency toward a lateral arrangement of branchlets.

The terminal twigs are curved, slender, round in section and average about 1.5 mm. in diameter and about 9 mm. apart. The calyces are sparsely distributed on the main stem and branches and rather regularly distributed on all sides of the branchlets and twigs, although there is a strong tendency to a lateral arrangement on distal twigs.

The individual calyces are conical or dome-shaped, a typical one measuring 1 mm. in height and 1.3 mm. in diameter. The walls are filled with oval, densely tuberculate spicules and the margin bears eight rather definitely marked lobes. The polyps are completely retractile and the tentacles are heavily armed with spindles which are arranged en chevron on the basal parts and in broad longitudinal bands on distal parts.

Spicules. The superficial spicules of the cœnenchyma are oval, very densely tuberculate forms, the real surfaces being concealed by the crowding of the tubercles. Under these are typical terete spindles with crowded verrucæ, usually not in very definite whorls. True girdled spindles seem to be wanting. The spicules of the axis are of the form typical of this genus.

Color. The colony is deep red or crimson throughout, and the polyps are yellow.

General distribution. Type locality. Ceylon Sea.

This handsome species is quite different in habit from any other of the genus in the collection.

5. *Suberogorgia appressa* new species. (Plate V, figs. 1, 1*a*; Plate XI, fig. 7).

Stat. 71. Makassar and surroundings. Up to 32 meters. Mud, sand with mud, coral.
Stat. 273. Anchorage off Pulu Jedan, East coast of Aru Islands. 13 meters. Sand and shells.

Colony flabellate, not reticulate. The stem and basal parts of main branches laterally compressed, other branches flattened. There are sharply defined grooves or furrows on anterior and posterior faces of all branches. The specimen is 46 cm. high and has a spread of about 50 cm. The main stem forks 4.2 cm. above its base and is very strongly laterally compressed, having a cross section of 2.3 cm. × 1.2 cm. The two main branches are directed outward and then curve upward and their basal parts are very strongly laterally compressed, further out they become round and their distal portions are flattened. They are irregularly enlarged in places, the enlargements being due to symbiotic barnacles. The main branches give off a few short branchlets from their lower sides and a number of branchlets, both simple and compound, from their upper sides; and these give off lateral branchlets until branchings of the 6th order are attained. The distance between branches, as well as their arrangement, is very irregular. The calyces are distributed in irregular patches on the surface of the main stem and branches, but are nearly all lateral on the distal parts of the colony.

The individual calyces are quite low verrucæ on proximal parts (although more prominent on the enlargements due to barnacles), but are entirely included on the distal parts, where they fade so insensibly into the general cœnenchyma that their size can not be determined. Their openings are surrounded by eight lobes which are separated by sharp, slit-like radiating incisions, quite different from other species that I have seen. The polyps are completely

retracted, and, when retracted, are disk-shaped. The entire dorsal surface of the infolded tentacles is covered with a complete armor of flattened longitudinal spindles or bar-like forms, there being numerous longitudinal series on each tentacle.

A cross section of a branch shows a relatively thin cœnenchyma filled with oval, closely tuberculated spicules. The water-vascular canals are inconspicuous and not so regular as in many species. They do not penetrate the axis. The axis is quite hard and well differentiated, composed of an agglutinated mass of spicules with horny sheaths and smooth surfaces and connected by various bridges and adhesions into a sort of mesh or network.

Spicules. These are almost entirely of two kinds; 1st regular, very short, usually oval spindles with close-set whorls of tubercles, there usually being four such whorls besides the distal caps; 2nd the irregular smooth spicules of the axis described above. Besides these there are the long flattened scale-like spindles of the tentacles.

Color. The colony is dark red, and the polyps white.

A very large specimen from Station 71 appears to belong to this species. It is 107 cm. in height and very profusely branched, the branching often being dichotomous and sometimes unilateral. The species agrees well in detail with the type, from Station 273, although the spiculation of the polyps can not be very well determined, the specimen being dried. The colony is covered with a white substance as if it had been overgrown with mould, but when fragments are placed in water they show an orange red color.

6. *Suberogorgia thomsoni* new species. (Plate VI, figs. 2, 2*a*; Plate XI, fig. 8).

Stat. 154. 0° 7′.2 N., 130° 25′.5 E. 83 meters. Gray muddy sand, shells and Lithothamnion. (Type).
Stat. 204. 4° 20′ S., 122° 58′ E. 75—94 meters. Sand with dead shells.

Colony flabellate, not reticulate, 8.5 cm. high and with a spread of about 5.5 cm. The stem and branches are round in section, although the latter appear flattened on account of the lateral arrangement of the polyps. Stem 1.9 mm. in diameter and 1.8 cm. long to first branch. The first branch is large, forming about half of the colony, and bears four lateral branches, three of which are compound. The remainder of the main stem bears seven lateral branchlets, two of which are compound. The branches tend to an alternate arrangement with very unequal spaces between them. The ultimate twigs are about 1 mm. in diameter. There are slight indications of median grooves on the main stem and larger branches, but they are quite indistinct and finally lost on distal parts of the colony. The calyces are regularly lateral and alternate in position.

The individual calyces are subconical in shape, a typical one measuring 1.2 mm. in height and 1.9 mm. in diameter at the base. The calyx walls are filled with comparatively heavy spindles, most of which are placed vertically. These differ materially from the oval forms which are found in the calyx walls of other species of this genus.

The polyps are completely retractile. The collaret is delicate, consisting of but one or two rows of slender encircling spindles, above which other spindles are arranged en chevron

over the tentacle bases. The rest of the dorsal surfaces of the tentacles bear a number of slender longitudinally disposed spindles.

A cross section of a branch shows practically the same structure described in connection with other species of this genus.

Spicules. The spicules of the cœnenchyma are much more typical spindles, especially in length, than those of other species described. The oval spicules so characteristic of other species are here almost completely lacking, and the spindles are proportionally much more slender. They are covered with conspicuous verrucæ which are not ordinarily in regularly disposed whorls. The spicules of the axis are smooth and are joined by cross connections into a sort of mesh.

Color. The colony is a light reddish brown in color.

A number of fragments from Station 204 apparently belong to this species. Some are more delicate than the type, but there are no other important differences.

7. *Suberogorgia pulchra* new species. (Plate VI, figs. 1, 1*a*; Plate XI, fig. 9).

Stat. 315. Anchorage East of Sailus Besar, Paternoster Islands. Up to 36 meters. Coral and Lithothamnion.

Several fragments, perhaps of the same specimen, were secured. The largest was flabellate, but straggling in habit, 23.5 cm. in height. The main stem and branches are somewhat flattened, the former having a cross section of 6 mm. × 4 mm. 1.3 cm. above its proximal end it gives off a simple undivided branchlet 14.8 cm. long, and 1.3 cm. higher it bifurcates. Each of the resultant branchlets gives off a single branchlet on one side and several usually simple ones, on the other. The ultimate branches are slender, slightly flattened and about 3 mm. in greater diameter. All of the stem and branches are traversed by distinct median grooves on one side, and most of them on two opposite sides. The calyces are all lateral in position, in two or three interrupted rows on each side of the branch.

The individual calyces are almost completely included, leaving little indication of their presence except in the very fine 8-rayed slits surrounding the calyx mouth. These slits are like sharp cuts radiating from the centre. The polyps are completely retractile, very small, and the dorsal surfaces of the retracted tentacles show a heavy armature of longitudinally placed red spindles showing conspicuously against the yellow substance of the tentacles.

A cross section of the stem shows the characteristic features of this genus.

Spicules. These are of much the same character as in *Suberogorgia appressa*. The cœnenchyma is packed with oval or disk-shaped forms which have their surfaces thickly crowded with coarse verrucae, which, however, are not arranged in regular whorls, but are emplanted irregularly but closely over the entire surface. The spicules of the axis form an agglutinated mass of tortuous bodies which unite in a sort of network or mesh.

Color. The entire colony is a yellowish red or terracotta, with the mouths of the calyces showing yellowish. The opercular spindles are crimson.

Genus **Korœides** Studer.

Korœides Studer. Versuch eines Systemes der Alcyonaria, 1887, p. 30.
Korœides Wright and Studer. Challenger Reports, the Alcyonaria, 1889, pp. xxxv, 168.
Korœides Nutting. Hawaiian Alcyonaria, 1908, p. 569.

The original definition, which has not been materially altered by subsequent writers so far as I have seen, it as follows: (Taken from Wright and Studer, 1889).

"The upright colony branches in one plane; the polyps form wart-like verrucæ, which are given off mainly from the sides of the somewhat flattened branches, leaving an interspace free. The spicules of the cœnenchyma are large broad spindles and polygonal, often triangular discs. These latter are closely approximated to one another, and form a pavement-like outer layer in the cœnenchyma. The calyces are thickly covered with polygonial scales, and the tentacles also contain broad smooth spicules. The whole habit, and even the character of the spicules, recall the genus *Acis*.

The axis is colorless and consists of closely intercalated calcareous spindles inclosed in a horny fibrous substance, which remains and preserves the form of the axis after decalcification".

The type of the genus *Korœides* is *K. koreni* W. and S. Two other species have been described, *K. gracilis* Whitelegge and *K. pallida* Hiles, both of which Thomson and Stimpson[1] regard as synonyms of *K. koreni*.

1. *Korœides koreni* Wright and Studer. (Plate VI, figs. 3, 3*a*).

Korœides koreni Wright and Studer. Challenger Reports, the Alcyonaria, 1889, p. 169.
Korœides koreni Thomson and Simpson. Alcyonarians of the Indian Ocean, II, 1909, p. 167.

Stat. 117. 1°0′.5 N. 122° 56′ E., 80 meters. Sand and coral.

Colony incomplete, very fragile, strictly flabellate, with flattened branches, 7.5 cm. high and with a spread of 14.5 cm. The main stem is round proximally, 3 mm. in diameter and 8 mm. high to first branch. At that point it sends off two opposite long tortuous branches which are round proximally and flattened distally. Their proximal branchlets are broken off, with one exception; but they fork distally into compound branchlets which are slightly flattened. The main stem is broken off 3.4 cm. above its base and is distinctly flattened above the first pair of branches, having a section of 3.3 × 2 mm. It gives off two short stubs and one compound branch on one side and one compound branch on the other. The compound branches are flattened, tortuous, and give off rudely alternate branchlets, two of which are compound and anastomose with branches below. The terminal twigs are really round, but appear to be flattened on account of the lateral disposition of the calyces, which are very uneven in distribution.

The individual calyces are quite variable in size and shape. When the polyp is fully retracted the calyx is almost entirely included. The usual form of the calyx, however, is a very short tube consisting of a fence of upright spicules with their points projecting in a series

[1] Alcyonarians of the Indian Ocean, II, 1909, p. 168.

around the margin. A typical calyx measures 1.5 mm. in height and about the same in diameter. In some calyx walls the large vertical spindles tend to an en chevron arrangement, in some they are vertical and in still others they are mainly horizontal. The polyps are completely retractile. The collaret is feeble and the tentacle bases bear rather strong spindles arranged en chevron, and above these each tentacle is armed with strong curved longitudinal spindles.

A cross section of a branch shows a moderately thick cœnenchyma filled with very large, warty horizontal spindles. The axis is more dense and well defined than in other genera of the Sclerogorgidæ. The spicules are definite in form, usually terete, but with a smooth surface like that of an icicle. They are not bound to each other by cross connections, but seem to adhere by their contiguous sides.

Spicules. The cœnenchyma and calyces are filled with very heavy spindles which have their whole surface packed with verrucæ which are not in definite whorls. Some of these spindles measure as much as 2.5 mm. in length and 1.5 mm. in diameter. They are almost exactly like those found in the genus *Muricella* or *Acis*. The spicules of the axis have already been described. They are much smaller than those of the cœnenchyma.

Color. The colony is a brilliant scarlet, but this color is obscured and given a pinkish cast by a whitish growth of sponge which covers it like a film. The axis is light yellow; the polyps are whitish, probably yellow in life, and the spicules are crimson and yellow.

General distribution. Type locality. Hyalonema Ground, off the coast of Japan, 345 fathoms. It has also been reported from the Laccadive Islands.

If Thomson and Simpson are right in combining the forms described as *Korœides gracilis* and *K. pallida* with *K. koreni*, the range of this species is much greater, embracing Funifuti (Whitelegge), Ceylon and the Andamans (Thomson and Henderson), New Britain (Hiles) and the Hawaiian Islands (Nutting).

DISTRIBUTION OF THE SCLEROGORGIDÆ COLLECTED BY THE SIBOGA EXPEDITION

List of Stations

at which Sclerogorgidæ were collected by the Siboga Expedition
and a List of Species collected at each Station.

STATION 71. Makassar and surroundings. Up to 32 meters. Mud, sand with mud, coral. *Suberogorgia appressa.*

STATION 81. Pulu Sebangkatan, Borneo Bank. 34 meters. Coral bottom and Lithothamnion. *Suberogorgia ornata.*

STATION 117. 1° 0′.5 N., 122° 56′ E. 80 meters. Sand and coral. *Korœides koreni.*

STATION 133. Anchorage off Lirung, Salibabu Island. Up to 36 meters. Mud and hard sand. *Suberogorgia rubra.*

STATION 154. 0° 7′.2 N., 130° 25′.5 E. 83 meters. Grey muddy sand, shells and Lithothamnion. *Suberogorgia thomsoni.*

STATION 164. 1° 42′.5 S., 130° 47′.5 E. 32 meters. Sand, small stones and shells. *Suberogorgia köllikeri.*

STATION 204. 4° 20′ S., 122° 58′ E. From 75—94 meters. Sand with dead shells. *Suberogorgia thomsoni.*

STATION 220. Anchorage off Pasir Pandjang, West coast of Binongka. 278 meters. Coral sand. *Suberogorgia ornata.*

STATION 257. In Duroa Strait, Kei Islands. Up to 52 meters. Coral. *Suberogorgia verriculata.*

STATION 260. 5° 36′.5 S., 132° 55′.2 E. 90 meters. Sand, coral and shells. *Suberogorgia rubra.*

STATION 273. Anchorage off Pulu Jedan, East coast of Aru Islands. (Pearl Banks). 13 meters. Sand and shells. *Suberogorgia köllikeri, S. appressa.*

STATION 274. 5° 28′.2 S., 134° 53′.9 E. 57 meters. Sand and shell. Stones. *Suberogorgia köllikeri.*

STATION 299. 10° 52′.4 S., 123° 1′.1 E. 34 meters. Mud, coral and Lithothamnion. *Suberogorgia verriculata.*

STATION 301. 10° 38′ S., 123° 25′.2 E. 22 meters. Mud, coral and Lithothamnion. *Suberogorgia rubra.*

STATION 305. Mid Channel in Solor Strait, off Kampong Menanga. 113 meters. Stony. *Suberogorgia köllikeri.*

STATION 307. Ipih Bay, South coast of Flores. 27 meters. Volcanic sand. *Suberogorgia verriculata.*

STATION 310. 8° 30′ S., 119° 7′.5 E. 73 meters. Sand with a few pieces of dead coral. *Suberogorgia köllikeri.*

STATION 315. Anchorage off Sailus Besar, Paternoster Islands. Up to 36 meters. Coral and Lithothamnion. *Suberogorgia pulchra.*

The table shows that species of this family were secured at 18 stations, and that one species was secured at each station, with the exception of Station 273 where two species were found. This station must have been exceedingly rich in alcyonarian life, although but two of the Sclerogorgidæ were secured here.

This family seems to be largely confined to shallow water, as but a single species was secured from a depth greater than 100 meters. The species referred to was *Suberogorgia köllikeri*, secured at Station 305 at a depth of 113 meters.

Two of the species in the Siboga collection, however, were secured by the Challenger off Japan at a depth of 345 fathoms. These are *Suberogorgia verriculata* and *S. köllikeri*.

If THOMSON and SIMPSON[1] are correct in regarding *Korœides gracilis* and *K. pallida* as synonyms of *K. koreni*, this species has a wider range than any other of the family Sclerogorgidæ in the collection, extending from the Indian Ocean to Japan and the Hawaiian Islands.

[1] Alcyonaria of the Indian Ocean, II, 1909, p. 167.

Family Melitodidæ Wright and Studer.

Melitea (in part) Lamouroux. Histoire des Polypiers coralligènes flexibles, 1816, p. 458.
Isidinæ (in part) Milne Edwards et Haime. Histoire Naturelle des Coralliaires, I, 1857, p. 192.
Melithæaceæ (in part) Kölliker. Icones Histiologicæ, II, 1865, p. 142.
Melithæadæ + *Mopselladæ* + *Trinellidæ* + *Ellisellad*æ (in part) Gray. Catalogue of Lithophytes in the British Museum, 1870, p. 24.
Trenellidæ Ridley. Contributions to the knowledge of Alcyonaria, Annals and Magazine of Natural History, Series V, Vol. X, 1882, p. 130.
Melithæidæ Ridley. Zoological Collections H. M. S. Alert, 1884, p. 356.
Melithæidæ Studer. Versuch eines Systemes der Alcyonaria, 1887, p. 30.
Melithæidæ Ridley. Alcyonaria of the Mergui Archipelago, Journal Linnæan Society, 1888, XXI, p. 244.
Melitodidæ Wright and Studer. Challenger Reports, the Alcyonaria, 1889, pp. xxxv, 170.
Melitodidæ Bourne. A treatise on Zoology, II, Chap. VI, 1900, p. 25.
Melitodidæ Kükenthal. Die Gorgonidenfamilie der Melitodidæ Verrill. Zoologischer Anzeiger, Bd. XXXIII, N° 7/8, 1908, p. 189.

On account of their striking superficial resemblance in the jointed axis to certain Isidæ, the species of the Melitodidæ and Isidæ were placed together by a number of the earlier writers, much to the confusion of the systematic arrangement of these forms. Lamouroux (1816) recognized the difference between the axes of this heterogeneous group of "Isidées" and formed the genus *Melitea* to accommodate species with spongy and inflated internodes, and included in it *Melitea ochracea*, *M. de risso* (= *Isis coccinea* Gmelin), *M. retifera* and *M. textiformis*.

Milne Edwards and Haime (1857) combine the genera *Isis*, *Mopsea* and *Melithæa* in their subfamily Isidinæ.

Kölliker (1865) included the genera *Melithæa* and *Mopsea* in his subfamily Melithæaceæ.

Ridley (1884) discusses the family "Melithæidæ" at considerable length and shows that the three families Melithæidæ, Mopsellidæ and Ellisellidæ of Gray can not be regarded as distinct, and includes them all in one family Melithæidæ in which he includes the following genera: *Melitodes*, *Clathraria*, *Wrightella*, *Mopsella*, *Acabaria*, *Trinella* and *Parisis*, and adds a new genus *Psilacabaria*.

Studer (1887) included in "Melithæidæ" the same genera as are included by Ridley, but combines the genera *Parisis* of Verrill and *Trinella* of Gray.

Wright and Studer (1889) substitute the name Melitodidæ for Melithæidæ of Ridley because the basis name for the old family was Melitæa, which had previously been used for a genus of insects; while Verrill (1863) proposed the generic name *Melitodes* as practically a substitute for Melitæa of earlier writers. This suggested the name Melitodidæ as a family designation proposed by Wright and Studer, who include the same genera that are named by Studer. Their definition of the family is as follows:

"Scleraxonia with a well-marked axis, which is jointed, i. e., consisting of alternating portions of a hard calcareous and a soft horny substance. The hard joints (internodes) consist of fused calcareous spicules, with but a trace of horny substance: the soft joints (nodes) are formed of loose calcareous spicules in a mesh of horny substance".

KÜKENTHAL (1908) gives a more extended definition, which may be translated as follows:

"Scleraxonia with an evident axis sometimes traversed by endodermal canals and consisting of soft (nodes) and hard (internodes) joints. The hard joints consist of complety fused calcareous spicules, and the soft joints consist of rod-like smooth spicules immersed in a horny material. The branching is dichotomous, usually from the nodes, and the colony is usually flabellate. The polyps are borne in calyces arranged either in the lateral borders or one side of the branches. The polyp spicules are spindles or clubs, the cortex spicules are in part "Blattkeulen".

This definition is acceptable for the purpose of the present work.

This same writer (KÜKENTHAL, 1908) furnishes an excellent key to the genera of the family Melitodidæ. This is so well devised that the following translation is offered, the new genus *Birotulata* being added:

1. Polyps with exserted calyces.
   - A. Branchings from the nodes, only the terminal twigs sometimes from the internodes.
     1. Cortex spicules spindles or thorny clubs.
        - *a*. Nodes and internodes traversed by water-vascular canals.
          Polyps ordinarily placed on one side of the branches . . . **Melitodes** Verrill.
        - *b*. Water-vascular canals not in the internodes.
          Polyps distant and biserially placed . . . . . **Acabaria** Gray.
     2. Cortex spicules foliaceous clubs . . . . . **Mopsella** Gray.
     3. The foliaceous clubs are nodular in form . . . . . **Wrightella** Gray.
     4. Cortex spicules double wheels . . . . . **Birotulata** Nutting.
   - B. Branchings from the internodes only . . . . . **Parisis** Verrill.
2. Polyps with inserted calyces . . . . . (**Clathraria**) Gray.

Synoptic view of the genera and species of MELITODIDÆ collected by the Siboga Expedition.

New genus and species are indicated by an asterisk (*).

Melitodes.

M. ochracea, *M. flabellum*, *M. variabilis*, *M. esperi* *M. *squamata*, *M. *modesta*.

Acabaria.

A. philippinensis, *A. tenuis*, *A. *formosa*, *A. *hicksoni*, *A. *triangulata*.

Mopseida.

M. clavigeri, *M. *studeri*, *M. *spongiosa*.

Wrightella.

W. coccinea, *W. tongœnsis*.

Parisis.

P. fruticosa, *P. minor*.

***Birotulata.**

*B. *minor*.

This table shows that the collection contained six genera, one of which is new and nineteen species, eight of which are new. The genus *Melitodes* has the largest representation, with six species, half of which are new; and *Acabaria* comes nexth with five species, two of which are new.

Systematic description of genera and species.

Genus **Melitodes** Verrill.

Isis (in part) Linnæus. Systema Naturæ, 12th edition, 1767, p. 1287.
Isis (in part) Ellis and Solander. Natural History of Zoophytes, 1786, p. 104.
Isis (in part) Pallas. Elenchus Zoophytorum, 1766, p. 230.
Isis (in part) Esper. Die Pflanzenthiere, 1791, Vol. I, p. 29.
Melitea Lamarck. Memoires Museum nat. hist., I, 1815, p. 410.
Militea Lamouroux. Hist. Polyp. flex., 1816, p. 458.
Melitea Lamarck. Hist. nat. Anim. sans Vert., 2, 1836, p. 470.
Melithæa Milne Edwards et Haime. Hist. Nat. des Coralliaires, I, 1857, p. 199.
Melitodes Verrill. Bull. Museum of Comp. Zool., 1864, p. 38.
Melitella Gray. Proc. Zool. Society of London, 1859, p. 485.
Melithæa (in part) Kölliker. Icones Histiologicæ, II, 2, p. 142.
Melitodes Studer. Versuch eines Systemes der Alcyonaria, 1887, p. 31.
Melitodes (in part) Wright and Studer. Challenger Reports, the Alcyonaria, 1889, p. 171.
Melitodes Bourne. A treatise on Zoology, Part II, Chap. VI, 1900, p. 25.
Melitodes Delage et Hérouard. Traité de Zoology Concrète, 1901, p. 414.
Melitodes Kükenthal. Die Gorgonidenfamilie der Melitodidæ, 1908, p. 190.

Pallas (1766) and other of the earlier writers included the species then known of this genus in the genus *Isis*.

Lamarck (1815) separated the genus Melithæa from *Isis*, as then known, by a definition which may be translated as follows:

"Colony fixed, tree-like, composed of a jointed axis and persistent cortical layer. Central axis rooted, branched, formed of stony joints substriated, with spongy and inflated internodes. The cortical layer contains the polyps when fresh, and small cellules when dried".

Lamarck (1815) and Milne Edwards and Haime (1857) give practically the same definition as the above.

Verrill, (1865) shows that the name Melithæa is preoccupied, and proposes the present name, Melitodidæ, for the family, and Studer (1887) adopts the name *Melitodes* for the type genus of the family, in which he has been followed by subsequent writers. Studer's definition for the genus may be translated as follows:

"*Melitodes* has all joints traversed by longitudinal canals. The spicules of the cœnenchyma are large warty spindles on the one hand and kneed ('knotige') spindles on the other".

Kükenthal (1908) gives a satisfactory definition which will be adopted here. A somewhat condensed translation is as follows:

"Colony almost always flabellate, branching, dichotomous, with branches from the nodes. Axis penetrated by water-vascular canals. Cœnenchyma variable in thickness and filled

with straight spindles, half-sided, thorny and kneed spindles, thorny clubs and irregular forms, but without foliaceous clubs. Polyps project from one side of the somewhat flattened branches and on their borders, and are retractile within exserted clayces".

The type of this genus is *Melitodes ochracea* (Pallas). The following list of species is taken largely from KÜKENTHAL's paper above referred to: *M. africana* Kükth., *M. albitincta* Ridley, *M. arborea* Kükth., *Melitodes densa* Kükth., *M. flabellum* Thomson, *M. flabellifera* Kükth., *M. fragilis* Wright and Studer, *M. lævis* Wrigt and Studer, *M. nodosa* Wright and Studer, *M. ornata* Thomson and Simpson, *M. pulchella* Thomson and Simpson, *M. rugosa* Wright and Studer, *M. rubeola* Wright and Studer, *M. stormii* Studer, *M. sinuata* Wright and Studer, *M. sulphurea* Studer, *M. variabilis* Hickson and the new species described in this report.

1. *Melitodes ochracea* (Linnæus).

Isis ochracea Linnæus. Systema Naturæ, 10th edition, 1758, p. 799.
Isis ocracea Pallas. Elenchus Zoophytorum, 1766, p. 230.
Isis ochracea Ellis and Solander. Natural History of Zoophytes, 1786, p. 105.
Isis ochracea Esper. Pflanzenthiere, I, 1791, p. 38.
Melitea ochracea Lamouroux. Histoire Polyps flexibles, 1816, p. 462.
Melitæa ochracea Lamarck. Histoire Naturelle des Animaux sans Vertèbres, II, 1836, p. 472.
Melithæa ochræea Kölliker. Icones Histiologicæ, 2, 1865, p. 142.
Melitodes ochracea Wright and Studer, Challenger Reports, the Alcyonaria, 1889, p. 292.
Melitodes ochracea Studer. Alcyonarien aus der Sammlung des Naturhistorischen Museums in Lübeck, 1894, p. 109.

Stat. 71. Makassar and surroundings. Up to 32 meters. Mud. Sand with mud. Coral. (Numerous specimens).
Stat. 85. 0° 36′.5 S., 119° 29′.5 E. 724 meters. Fine grey mud.
Stat. 234. Nalahia Bay, Nusa Laut Island. 46 meters. Stony.

A number of large dried specimens, very much broken up, must be referred to this species. One of these must have been a magnificent spectacle when alive, as the incomplete specimen measures over one meter in height and 5.9 cm. in diameter at base. The main stem and branches are strongly compressed laterally, but the smaller branches are ronnd. The nodes are indicated externally by annular swellings, but they are almost obliterated internally in the larger branches. In a branch 8 mm. in diameter, for instance, the nodes can scarcely be seen, being indicated in a longitudinal section by an indistinct narrow band less than 1 mm. broad, while the adjacent internode is 20 mm. long. The polyps are thickly distributed on three sides of the branches, leaving a broad posterior face bare. The branching is usually dichoto mous, but sometimes lateral. The calyces are included, and the characters of the polyps can not be made out in the dried specimens. The axis is penetrated by numerous canals.

Spicules. The spicules are mostly small oval spindles with proportionally large densely crowded verrucæ. The hard internodes are made up of an agglutinated mass of rod-like spicules which adhere together so strongly that they do not boil apart in caustic potash. The cœnenchyma contains a number of warty clubs, and there are also warty spindles, probably from the polyps.

Color. The entire colony is a dark brick red. Axis darker. In other specimens the general surface of the smaller branches is yellow, with scarlet verruciform calyces, the back and sides being bright yellow.

General distribution. The Indian Ocean, which is the type locality.

2. *Melitodes flabellum* Thomson and Mackinnon.

Melitodes flabellum Thomson and Mackinnon. Alcyonaria of the Percy Sladen Trust Expedition, Part II, 1910, p. 198.

Stat. 164. 1°42′.5 S., 130°47′.5 E. 32 meters. Sand, small stones and shells.
Stat. 261. Elat, West coast of Great Kei Island. 27 meters. Mud.
Stat. 273. Anchorage off Pulu Jedan, East coast of Aru Islands. 13 meters. Sand and shells.
Stat. 305. Mid Channel in Solor Strait, off Kampong Menanga. 113 meters. Stony.
Stat. 310. 8°30′ S., 119°7′.5 E. 73 meters. Sand, with few pieces of dead coral.

Colony strictly flabellate and reticulate, 19.5 cm. long and with a spread of 12.5 cm. The main stem is nearly round, the horny joints (internodes) being 5 mm. in diameter and the calcareous nodes 3.5 mm. in diameter. The internodes are about 5 mm. long, and the nodes 3 to 4 mm. The branches are borne on the internodes and are typically alternate and lateral in position. From its basal 6.5 cm. the stem gives off occasional irregular branchlets which do not form a part of the flabellate structure. Above this point the stem soon dissipates itself in a reticulate mass of branches and branchlets, the branching being, in general, dichotomous. In the fan the internodes are usually about 9 mm. in length and 1 mm. in diameter; while the nodes are triangular, as a rule, the triangle being about 2 mm. long and nearly equilateral. Most of the branchlets terminate in U-shaped bifurcations on the margins of the fan. Nearly all of the calyces are lateral in position, forming a close-set row on each side of the branches and twigs. In places the row is quite even, but in others it is decidedly zigzag.

The individual calyces are quite small, rather low, dome-shaped verrucæ, averaging less than .5 mm. in height and slightly over 1 mm. in diameter, the gradually sloping wall of one meeting that of its neighbor so as to give a scalloped appearance to the margins of the branches, when viewed from above. Their apertures are almost completely closed, in the specimen described, and their walls are filled with heavily tuberculated spindles and spiny clubs which form an indistinct circlet of prominences around the margins.

The polyps are minute, but show a well defined collaret composed of one or two rows of bent spindles and a pseudo-operculum of similar spindles arranged en chevron basally and disposed longitudinally on distal parts of tentacles; the whole forming a symmetrical rosette when viewed from above.

Spicules. Those of the axis are small, smooth, bar-like forms aggregated together into a felted mass which is less dense in the horny and more dense in the calcareous nodes. They do not boil apart in caustic potash. The spicules of the cœnenchyma are exceedingly varied in form, but are all modifications of the tuberculate spindle on the one hand and of the spiny club on the other. The spindles are densely tuberculate and usually short and stout,

but sometimes slender and curved. The clubs are all of the spiny type, none of the Blattkeulen being present. The spindles immensely preponderate over the clubs in number.

Color. The colony of the specimen described is a light grayish brown and the spicules are colorless. Another specimen from the same station is dull red.

General distribution. Type locality. Providence, Indian Ocean, 6 fathoms.

A specimen from station 305 is a flabellate, matted mass as if several fans lying in parallel planes had been united by horizontal connections, very much resembling the illustration given by THOMPSON and SIMPSON (Alcyonarians of the Indian Ocean, 88, 1909, p. 170) of *Melitodes variabilis*. But one internode of the stem remains, and this is 3 mm. broad and nearly 4 mm. long and the accompanying internode is longitudinally furrowed, 2.3 mm. in diameter and 4 mm. long. The stem forks at the node and the resultant branches bear numerous branchlets, or bifurcate repeatedly; some of the branchlets being inclined forward and some backward, each being compressed and flabellate thus forming a colony composed of several palmate structures in parallel planes which are held together by branches passing from one to the other and anastomosing. The resulting network is quite irregular. The main branches are laterally compressed. In details and spiculation, however, this specimen agrees with the one described above.

3. ? *Melitodes variabilis* Hickson.

Melitodes variabilis Hickson. The Alcyonaria of the Maldives, III, Vol. II, 1905, p. 809.
Melitodes variabilis Thomson and Simpson. Alcyonarians of the Indian Ocean, II, 1909, p. 169.
Melitodea variabilis Thomson and Mackinnon. Alcyonaria of the Percy Sladen Trust Expedition, Part II, 1900, p. 198.

Stat. 60. Haingsisi, Samau Island, Timor. 23 meters. Lithothamnion in 3 meters and less. Reef.
Stat. 274. 5° 28′.2 S., 134° 53′.9 E. 57 meters. Sand and shells. Stones.

The specimens secured by the Siboga Expedition are fragmentary. They show the red nodes and white internodes of this species. The larger specimen from Station 60 consists of the base of attachment and a few stumpy and divergent branches.

In the specimen from station 274 the calyces are yellow.

General distribution. "Throughout the Maldives" (HICKSON). Indian Ocean.

4. *Melitodes esperi* Wright and Studer.

Melitodes esperi Wright and Studer. Challenger Reports, the Alcyonaria, 1889, p. 179.

Stat. 33. Bay of Pidjot, Lombok. 22 meters and less. Mud, coral and coral sand.
Stat. 50. Bay of Badjo, West coast of Flores. Up to 40 meters. Mud, sand and shells.
Stat. 60. Haingsisi, Samau Island, Timor. 23 meters. Lithothamnion.
Stat. 80. 2° 25′ S., 117° 43′ E. 50—40 meters. Fine coral sand.
Stat. 144. Anchorage north of Salomakieë (Damar) Island. 45 meters. Coral bottom and Lithothamnion.
Stat. 164. 1° 42′.5 S., 130° 47′.5 E. 32 meters. Sand, small stones and shells.
Stat. 257. In Duroa Strait, Kei Islands. Up to 52 meters. Coral.

Stat. 273. Anchorage off Pulu Jedan, East coast of Aru Islands. 13 meters. Sand and shells.
Stat. 315. Anchorage east of Sailus Besar, Paternoster Islands. Up to 36 meters. Coral and Lithothamnion.

Colony strictly flabellate and reticulate, the distal part only being present and consisting of four large branches connected by numerous anastomoses. Height 16.5 cm. Spread 10 cm. The main branches are laterally compressed, a cross section of a typical one being 2 × 3.1 cm. The nodes are 6 to 14 mm. long, the longer ones being in the distal parts of the colony, and the internodes are 2 to 5 mm. long, the longer ones being in the basal parts of the colony. The branching is usually dichotomous, and the anastomoses are through short lateral connections. The smaller branchlets also are laterally compressed, a typical one being 1.1 × 1.9 mm. in section. The calyces are thickly distributed over three sides of the branches, leaving the back of the colony bare, as a rule, although there are calyces on this side of some of the twigs.

The calyces are almost entirely included in the specimen described. This is probably due, however, to the state of retraction of the polyps, for in other specimens, where the polyps are expanded, the calyces appear to be tubular with spicules arranged en chevron around the upper parts. The upper parts of the calyces are yellow, in sharp contrast to the rich crimson of the general cœnenchyma. Their walls are filled with short densely tuberculate spindles, sometimes oval or disc-shaped, which appear like imbricating scales, the upper edge of one overlapping the lower edge of another. The margin is surrounded by eight lobes.

The polyps are completely retractile and are furnished with a strong collaret above which are eight points formed usually by two spicules at the base of each tentacle, each pair having its distal ends approximated and its proximal ends divaricated. Above these points the dorsal surface of each tentacle is covered with an incrustation of densely tuberculate yellow spicules which are usually longitudinally disposed.

Spicules. Those found in the cœnenchyma are variously formed tuberculate spindles and spiny clubs. The spindles are often oval or disk-shaped with the tubercles sometimes arranged in definite whorls and sometimes very heavy and without definite arrangement. A few curved spindles are also seen. Some of the clubs are tuberculate and others spiny.

Color. The colony is deep crimson with the polyps and calyx margins bright yellow.

General distribution. Type locality. Torres Strait.

A specimen from Station 144 agrees quite closely in coloration with RIDLEY's figure of *Psilacabaria gracillima* [1].

5. *Melitodes squamata*, new species. (Plate VII, figs. 1, 1*a*, Plate XII, fig. 1).

Stat. 299. 10° 52.4 S., 123° 1'.1 E. 34 meters. Mud, coral and Lithothamnion.

Colony flabellate, but not reticulate, although it appears to be so. 27.5 cm. in height and about 10 cm. in width. The stem and branches are approximately round in section. The first large branch is 2.6 cm. above the base of the stem. The horny nodes are much swollen,

[1] Zoological Collections H. M. S. Alert, 1884, pl. XXXVI, fig. E[1].

8 mm. in diameter and 6 mm. long. The calcareous nodes are 6 mm. in diameter and about 4 mm. long. All of the branches are borne on the horny nodes which vary in length from 5 mm. on proximal branches to 12.5 mm. on distal branchlets. The first are annular and the latter triangular in outline. The calcareous nodes vary from 4.1 mm. to 12.5 in length, the latter being the distal ones. The main branches are lateral and alternate in position, but the distal branchings are regularly dichotomous, the forkings being U-shaped. The ultimate twigs are very slender, being but 1 mm. in diameter. The polyps are distributed on all sides of the smaller branches and branchlets, and on three sides of the more proximal branches and parts of branches. They are usually lateral on the main stem and branches.

The individual calyces are minute, almost entirely included even when the polyps are partly expanded, and about 1 mm. in diameter. They are rendered conspicuous by their color which is a brilliant crimson while the general cœnenchyma is a yellowish red or deep orange. Their walls are filled with crimson spicules which look like small imbricating disks when in situ. The polyps are quite heavily spiculated. There is a strong collaret often of crimson, sometimes of light yellow spicules, above which is a pair of spicules forming a point above each tentacle base by the approximation of their distal ends. These spicules are also often crimson in color. Above these points other strong spindles lie along the distal parts of the dorsal surfaces of the tentacles.

The cœnenchyma of the branches appears to be filled with rounded or disk-like imbricating scales.

Spicules. Those of the cœnenchyma are disk-like tuberculate forms intergrading with ordinary spindles with tubercles arranged in regular whorls. Tuberculate clubs are also seen in moderate numbers, but I find no spiny clubs or Blattkeulen. The spicules of the axis are smooth bars and needle-like forms, resembling fragments of spun glass when viewed through the microscope. Bent tuberculate spindles are found in the polyps.

Color. The colony is orange red, in general coloration, but the distal parts lighten to almost white, as if they had been partly dried or bleached. The calyces are crimson and the polyps yellow or pallid.

6. *Melitodes modesta*, new species. (Plate VII, figs. 2, 2*a*; Plate XII, fig. 2).

Stat. 164. 1°42′.5 S., 130°47′.5 E. 32 meters. Sand, small stones and shells.
Stat. 273. Anchorage off Pulu Jedan, East coast of the Aru Islands. 13 meters. Sand and shells. (Type).
Stat. 274. 5°28′.2 S., 134°53′.9 E. 57 meters. Sand and shells. Stones.

Colony strictly flabellate and moderately reticulate, 13 cm. high and with a spread of 7.5 cm. The main stem grows from an expanded base which seems originally to have supported two such stems. The remaining stem shows that a large branch has been broken off immediately above the base, and above this the stem gives off alternate branches, one from each node. The second free node is about 4 mm. long and the same in diameter, while the internode below it is about 3 mm. in diameter and length; but the nodes and internodes blend so as to make it difficult to ascertain their limits. As in other species of this genus the nodes decrease

and the internodes increase in length as we go from proximal to distal parts of the colony where the nodes are but a little more that 1 mm. and the internodes are sometimes 9 mm. long. The branchings are mainly dichotomous and the forkings are U-shaped. Many of the smaller branches are frequently girdled by a small parasitic form which looks like checkered belts or bands tightly compressing the cœnenchyma. The calyces are mainly lateral and anterior in position, and are so low as to be barely visible.

The individual calyces are very low rounded domes, more evident on the distal twigs then elsewhere. They are very small, averaging scarcely more than .1 mm. in diameter. Their walls are filled with spiny spindles and thorny clubs, the edges of which give a serrated appearance. The polyps are very small and so completely retracted that their characters are hard to make out. They have a strong collaret above which are spindles arranged en chevron over the tentacle bases and longitudinally on the dorsal surfaces of the tentacles. In certain stages of retraction these latter spicules form a series of points beyond which the tentacles suddenly bend downward.

Spicules. These are mainly rather large spiny spindles, with the individual spines often spinulate. There are also one-sided spindles, spiny clubs and numerous other forms, all of which are but modifications of the spiny spindle characteristic of this genus.

Color. The colony is lemon yellow and the axis is dark pink.

Other specimens are more robust than the type described, and the calyces are distributed on all sides of the distal branches. These specimens are light orange brown, instead of yellow, in color.

Genus **Acabaria** Gray.

Acabaria + *Anicella* Gray, Annals and Magazine of Natural History, 4th Series, Vol. 2, 1868, p. 444.
Acabaria Ridley. Zoological Collections H. M. S. Alert, 1884, p. 360.
Acabaria Studer. Versuch eines Systemes der Alcyonaria, 1887, p. 31.
Acabaria Wright and Studer. Challenger Report, the Alcyonaria, 1889, p. XXXVI.
Acabaria Delage et Hérouard. Traité de Zoologie Concrète, II, 2, 1901, p. 414.
Acabaria Kükenthal. Die Gorgonidenfamilie der Melitodidæ, Zoolog. Anz. Bd. XXXIII, 1908, p. 194.

The original definition of this family is as follows:

"The coral very slender, branched dichotomous, expanded in a plane; branches and branchlets very slender, compressed, with short swollen joints, more pronounced on the older stems. Bark thin, hard, smooth. Cells short, broad, subcylindrical, truncated, in a single series on each edge of the branches and branchlets, rather close together. Axis calcareous, solid, red, longitudinally grooved; internodes short, swollen spongy".

The same author proposes the genus *Anicella*, based on an Australian species with internodes (nodes, as the term is now used) red, swollen. This can hardly be regarded as a generic character, and the species should be included in *Acabaria*.

Ridley (1884) practically adopts the above definition, but establishes a new genus *Psilacabaria*, which Kükenthal (1908) would include in *Acabaria*.

Studer (1889) gives a very brief characterization of this genus.

"*Acabaria* Gr. Wie *Mopsella*, aber die Spicula der Rinde sind nur Spindeln".

Kükenthal (1908) gives a satisfactory definition, as indicated in the following translation:

"Branching flabellate, dichotomous, branches originating at the nodes. Branches very slender, slightly or not at all flattened. Internodes not pierced by water-vascular canals. Polyps retractile within large calyces, biserially arranged and usually widely spaced. Spicules never foliaceous clubs".

The type species of this genus is *Acabaria divaricata* Gray. Other described species are *Acabaria australis* Gray, *A. biserialis* Kukth., *A. corymbosa* Kükth., *A. erythracea* (Ehrenb.), *A. frondosa* (Brundin), *A. gracillima* (Ridley), *A. habereri* Kükth., *A. japonica* Verrill, *A. philippinensis* (Wright and Studer), *A. serrata* Ridley, *A. tenuis* Kükth., *A. undulata* Kükth., *A. valdiviæ* Kükth., and the new species described in the present work.

1. *Acabaria philippinensis* (Wright and Studer).

Melitodes philippinensis Wright and Studer. Challenger Reports, the Alcyonaria, 1889, p. 176.
Melitodes philippinensis Thomson and Simpson. Alcyonarians of the Indian Ocean, II, 1909, p. 172.

Stat. 310. 8° 30′ S., 119° 7′.5 E. 73 meters. Sand, with a few pieces of dead coral.

Specimens flabellate, the largest being a fragment 6.2 cm. long and about 4 cm. in spread. Stem and branches round. Main stem 2.1 mm. in diameter and 1.5 cm. long to first branch. The first complete node is 4 mm. long and 3 mm. in diameter, and a distal one is 1.2 mm. long. The proximal internode is 1 cm. long and 2 mm. in diameter, while a distal internode is 1.4 cm. long and 8 mm. in diameter. The branching is irregularly dichotomous and the furcations are Y-shaped rather than U-shaped. The calyces are mostly lateral leaving a broad bare space on the back of the colony and a narrow one, sometimes invaded by calyces, on the front. There is often a tendency to form a zigzag row on the side of the branch.

The individual calyces are dome-shaped verrucæ, often hemispherical when the polyps are completely retracted. They are somewhat closely approximated on the sides of the branches and are rendered conspicuons by their dark red color in contrast with the dull yellow of the cœnenchyma. A typical calyx measures .7 mm. in height and 1.3 mm. in diameter at the base. Their walls are filled with coarse tuberculate spindles which sometimes tend to an en chevron arrangement around the margin and otherwise are horizontal or irregularly disposed. A few of the more superficial spicules are yellow, but the rest are red, the predominating color in the calyces. The polyps are retractile and have a strong collaret composed of about three horizontal rows of red tuberculate spindles, above this other spindles are arranged en chevron over each tentacle base, forming a series of 8 points above the collaret. The remainder of the dorsal surface of the tentacles bears longitudinal yellow spindles.

Spicules. These are mostly rather stout terete spindles, sometimes assuming an oval outline, and with definite whorls of promiment tubercles on the more slender spindles and

with irregularly placed tubercles on the stouter ones. There are also a number of clubs, most of which are tuberculate rather than thorny. Many of the spindles are curved.

Color. The colony is red and yellow. The cœnenchyma is a dull yellow, owing to the red axis showing through the yellow layer of spicules. The calyces are dark dull red with a few superficial yellow spicules. The polyps are red and yellow.

General distribution. The type locality of this species is Samboangan Reefs. It has also been reported from the Indian Ocean by THOMSON and SIMPSON.

2. *Acabaria tenuis* Kükenthal.

Acabaria tenuis Kükenthal. Die Gorgonidenfamilie der Melitodidæ, Zoolog. Anz. Bd. XXXIII, 1908, p. 195.

Stat. 117. 1°0′.5 N., 122°56′ E. 80 meters. Sand and coral.
Stat. 144. Anchorage north of Salomakieë (Damar) Island. 45 meters. Coral bottom and Lithothamnion.

A number of fragments were secured. The largest is flabellate and not reticulate, exceedingly delicate and fragile. Height 5.8 cm., spread 2.1 cm. The main stem forks 7.1 mm. from its proximal end, one of the resultant branches being missing. The stem is only 18 mm. in diameter. The branching is in general dichotomous. The distal branches are less than .5 mm. in diameter between the calyces. The basal node of the stem is 2 mm. long, while the internode below it is 5 mm. long. Some of the distal internodes are 8 mm. long. The branching is dichotomous, as a rule, and the furcations are Y-shaped rather than U-shaped. The calyces are lateral in position and vary greatly in size as well as in spacing. They average about 1.5 mm. apart.

The individual calyces are tubular in form and more prominent than is usual in this family. A typical one measures .9 mm. in height and 1 mm. in diameter at the base. The calyx walls are filled with spindles which are irregularly horizontal on the basal parts and arranged en chevron on the distal parts, arising in 8 blunt points around the margin. The polyps are retractile, but are often seen with their collarets resting just above the calyx margin. The polyps are armed with yellow spicules. There is a collaret of relatively heavy spindles in two or three rows, those of the upper row forming low points, each point consisting of the approximated distal ends of two spicules on the tentacle base. Above these points a few other spindles form a rude en chevron arrangement which is succeeded by vertically placed spindles on distal parts of tentacles.

The cœnenchyma is thin and contains spindles and spiny clubs usually disposed longitudinally.

Spicules. In this species there is a relatively large number of slender curved spindles, most of which bear regular whorls of verrucæ. Others bear irregularly distributed thorny points. Clubs with thorny points are also found, but are much less numerous than the spindles. Besides these there are a number of irregular forms, as in all species of this family; but none are sufficiently numerous to be regarded as characteristic of the species.

Color. The colony is a bright scarlet and the polyps are white with chrome yellow spindles. The spicules are red and yellow.

General distribution. The type locality is Sagami Bay, Japan; 600 meters. It has also been reported from Okinose Bank, Japan; 80—260 meters.

The specimen from Station 114 is very delicate, with reddish polyps. It is referred with some doubt to this species.

3. *Acabaria formosa* new species. (Plate VII, figs. 3, 3*a*; Plate XII, fig. 3).

Stat. 240. Banda Anchorage. 9 to 45 meters. Black sand and coral. Lithothamnion bank in 18—36 meters.

The specimens consist of a number of fragments which are exceedingly fragile and brittle. One of the larger fragments consists of a branch 8 cm. long. The denuded axis of the main stem of the branch is 1.9 cm. long and is round, having a diameter of 1.2 mm. It bifurcates at the first node which is triangular in form, 2.8 mm. long and almost equilateral. Each of the branches bifurcates twice, but one resultant branchlet is missing, and the branches are separated by a comparatively wide angle. The furcation is angular and not U-shaped as in so many species of this genus. The internodes of the branches are fairly even, averaging about 1.4 mm. long and 1.5 mm. in diameter between the calyces. The calyces are all lateral and usually alternate, those on one side often showing a tendency to bend alternately to the front and back, like the teeth of a saw.

The individual calyces are very large and conspicuous and their golden yellow color is remarkably vivid. They are in the form of symmetrical truncated cones, a typical one measuring 1.7 mm. high and 2.1 mm. broad at the base. Their walls are straight and do not curve to the general level of the cœnenchyma, as is usually the case, but are sharply differentiated from their very bases. The distance between adjacent calyces varies, but 1.5 mm. seems fairly typical. The margin bears 8 regular scallops or lobes, the polyps are retractile, but usually rest with their collarets just above the calyx margins. They are heavily spiculated, with a well-marked collaret composed of strong bent spindles in two or three encircling rows. Above the collaret the spindles are arranged en chevron over the tentacle bases, forming 8 strong points, each point being composed of a bundle of spindles. Beyond these points the dorsal surfaces of the tentacles are armed with longitudinal spindles.

Spicules. These are thorny spindles and clubs. The spindles are usually more slender than in most Melitodidæ and often curved. They are relatively quite numerous. There are also small spindles with two whorls of verrucæ in addition to the terminal knobs. The characteristic clubs show a proximal comparatively smooth acicular part and a clavate distal portion armed with numerous spiny points. The spicules of the axis are deep crimson.

Color. The colony in general, including the polyps, is a very vivid chrome yellow and the axis is bright crimson. The cœnenchyma is thin and allows the color of the axis to show through as a bright pink. This is one of the most brilliantly colored species that I have seen.

Acabaria formosa is allied to *A. biserialis* Kükenthal, but is stouter, and the calyces are much larger.

4. *Acabaria hicksoni* new species. (Plate VIII, figs. 3, 3*a*; Plate XII, fig. 4).

Stat. 60. Haingsisi, Samau Island near Timor. Reef. 23 meters. Lithothamnion in 3 meters and less.

Specimens consisting of a number of fragments. The largest is sub-flabellate in form and very erratic and straggling in its manner of growth. The proximal part is gone, and its form is such that it is difficult to tell which is the main stem or branch. The specimen is 6.6 cm. in length and about 3.5 cm. in spread. The largest branch is 1.5 mm. in diameter between the calyces. The nodes are not sharply distinguished from the internodes, and are not so distinctly triangular in shape as is often the case. They vary from 2.5 mm. (proximal) to 1.2 mm. (distal) in length. The internodes vary from 4 mm. (proximal) to 13 mm. (distal) in length. The branching is such that the greater part of the specimen is in two parallel planes. The branching is dichotomous, as a rule, but there are a number of ultimate lateral branchlets. The furcations are Y-shaped rather than U-shaped. The calyces are mainly lateral in position, where they are rather close set and tend to an alternate position.

The individual calyces are in the form of low domes when the polyps are completely retracted, and short tubes when they are expanded. A typical one measures 1 mm. in height and 1.2 mm. in diameter. The spiculation of the calyx walls shows a basal arrangement of horizontal spicules, but an en chevron arrangement toward the margins. The polyps, in partial retraction, form a strongly marked 8-rayed figure or rosette when viewed from above. There is a well-marked collaret of reddish spicules, above which is an en chevron arrangement of spindles on the tentacle bases which blends in color from red to yellow. The remainder of the dorsal surfaces of the tentacles are provided with longitudinal yellow spindles, and an oblique series of spindles is on each side of the tentacle extending from the dorsal surface to the pinnule bases, forming an armature that is unusual in this family.

Spicules. These are much as in *Acabaria tenuis* Kükenthal. The spindles seem to be a little heavier on the average, but I fail to find any specific differences, so far as the form of the spicules is concerned.

Color. The colony is a dark red and the polyps are red and yellow.

This species differs from *Acabaria tenuis* in being of a more robust habit, in irregularity of branching, in larger calyces and thicker branches and in the spiculation of the polyps.

5. *Acabaria triangulata* new species. (Plate VIII, figs. 2, 2*a*; Plate XII, fig. 5).

Stat. 260. 5° 36′.5 S., 132° 55′.2 E. 90 meters. Sand, coral and shells.
Stat. 274. 5° 28′.2 S., 134° 53′.9 E. 57 meters. Sand and shells, stones. (Type locality).

The colony is sub-flabellate in form, 6.3 cm. high and 1.5 cm. broad. The stem and branches are round in section. The main stem is 1.5 cm. long to the first branch and 1.9 cm. in diameter. The second node is 3.8 mm. long and 3 mm. broad, and a distal node is 1 mm.

long. The second internode is 6 mm. long, and a distal one 8 mm. long. The main stem bifurcates 1 5 cm. from its base into two irregular branches which are erect and nearly parallel, giving off alternate branchlets, one from each node. The largest branch is sinuous. The distance between branches varies, as do the length of the internodes. The calyces are lateral in position, not so crowded as in many species, and leave proportionally broader naked areas on the back and front of the branches.

The individual calyces are quite small dome-shaped verrucæ which show as dark red swellings in contrast with the lighter red of the cœnenchyma. An average calyx measures .5 mm. in height by .7 mm. in diameter, thus being smaller than any other species of this genus in the collection. The calyx walls are filled with Stachelkeulen the spiny points of which give a bristling appearance. The polyps are very small, retractile and, on account of their red color being the same as that of the calyces, hard to study. The spiculation, however, seems to be the same as in allied species, consisting of a collaret of transverse spicules above which 8 points are formed by two or more spindles on each tentacle base meeting at an angle, and a distal series of longitudinal spindles on the dorsal surfaces of the tentacles.

Spicules. These are quite different from those of other species of the genus the most characteristic ones being triangular in outline with their surfaces covered with large warty tubercles. These triangles are large, and are modifications of the spiny club type, many of them showing short thorny or foliaceaous projections from their club end. Both Blattkeulen and Stachelkeulen are found, the latter predominating. Ordinary spindles are rather rare. When present they are usually short, curved and ornamented with whorls of verrucæ.

Color. The colony is a dark, rather dull, coral red and the calyces and polyp spindles a dark crimson red.

Genus **Mopsella** Gray.

Mopsella Gray. Proceedings Zoological Society of London, 1857, p. 248.
Mopsella Ridley. Zoological Collections H. M. S. Alert, 1884, p. 258.
Mopsella Studer. Versuch eines Systemes der Alcyonaria, 1887, p. 31.
Mopsella Wright and Studer. Challenger Reports, the Alcyonaria, 1889, p. XXXVI.
Mopsella Kükenthal. Die Gorgonidenfamilie der Melitodidæ, Zoolog. Anz. Bd. XXXIII, 1908, p. 198.

The original definition of this genus is not at present accessible to the writer. Ridley (1884) emphasizes the necessity of depending largely on spicule characters in defining genera of this family.

Studer (1887) gives as the character of the genus the penetration of the internodes by the water-vascular canals and the presence of spindles and foliaceous clubs among the spicules.

Kükenthal (1908) gives the first satisfactory definition of the genus, which may be translated as follows:

"Colonies usually flabellate. The branching is dichotomous and from the nodes. Axis usually penetrated by water-vascular canals. Cortical spindles foliaceous clubs. Polyps in low calyces on the sides and one surface of the usually not flattened branches".

This definition is a satisfactory one for our present purpose, and will be adopted.

The type species of this genus is *Mopsella textiformis* (Lamarck). Other described species are *Mopsella amboynesis* Kükth., *M. clavigera* Ridley, *M. dichotoma* (Pallas), *M. coccinea* (Ellis and Solander), *M. klunzingeri* Kükth., *M. sanguinea* Kükth., *M. zimmeri* Kükth.; and the new species described beyond.

1. *Mopsella clavigera* Ridley.

Mopsella clavigera Ridley. Zoological Collections H. M. S. Alert, 1884, p. 360.

Stat. 53. Bay of Nangamessi, Sumba. Up to 36 meters. Coral sand. Near the shore, mud.

A fragmentary specimen from this station shows the strongly compressed axis and main stem, and peculiar spicules figured by RIDLEY, l. c. Plate XXXVIII, fig. a, a′, a‴, for *M. clavigera*. The specimen is dry and nearly all of the branches are missing. The internodes are pinkish and the nodes crimson. The calyces and polyps can not be satisfactorily studied.

Spicules. The spicules are exceedingly various in form, but those figured by RIDLEY are quite characteristic. There are numerous clubs with comparatively smooth surfaces, and others flattened and longitudinally grooved, forming figures like two or three extended fingers flattened and closely pressed together. Many also are like irregular potatoes in form, with rounded swellings unlike other verrucæ, and sometimes thorny points. Regular tuberculate spindles with the verrucæ in symmetrical whorls are also found.

Color. The colony is dull red and the axis has pink internodes and crimson nodes.

General distribution. The type locality of this species is in the Indian Ocean.

2. *Mopsella studeri* new species. (Plate IX, figs. 41*a*; Plate XII, fig. 6).

Stat. 71. Makassar and surroundings. Up to 32 meters. Mud, sand with mud, coral.
Stat. 273. Anchorage off Pulu Jedan, East coast of Aru Islands (Pearl Banks). 13 meters. (Type locality).
Stat. 274. 5° 28′.2 S., 134° 53′.9 E. 57 meters. Sand and shells. Stones.

Colony flabellate and reticulate, 25.3 cm. high and with a spread of 11.5 cm. Two main stems are coherent at base, forming a common stock 1.5 cm. × 1 cm. in diameter. These separate about 2 cm. from the base, but are reunited by a single anastomosis of the branches. Stem and branches laterally compressed, the larger stem having a cross section of 9 mm. × 7 mm. In the lower part of the main stem the nodes blend with the internodes so as to make it difficult to ascertain their limits on superficial examination, but the nodes are evidently much longer than the internodes. On the branches and twigs this relation is reversed, the internodes being much the longer. Some of the distal nodes are but 2 mm. long, while adjacent internodes are 11 mm. long. The branching is dichotomous in general, but sometimes lateral and alternate. The furcations are usually U-shaped. Some of the main branches are much compressed, one having a section of 3.8 mm. × 2 mm. The ultimate twigs are nearly round and average about 1 mm. in diameter, the calyces are very thickly emplanted on three sides of the stem and main branches and on all sides of the smaller branches and twigs.

The individual calyces are quite small dome-shaped verrucæ when the polyps are completely retracted, and short tubes when they are completely expanded. They are so closely crowded on the surfaces of the branches as to be contiguous at their bases. A typical one measures .9 mm. in diameter at the base. The height varies in accordance with the state of expansion of the polyps, but seldom exceeds 1 mm. The calyx walls are armed with very jagged spindles and Blattkeulen and, in certain stages of contraction of the polyps, the margin is distinctly 8-lobed. The polyps have a rather slender collaret, above which the spindles form eight points. Beyond these points there are a few longitudinal spindles, lying along the dorsal surfaces of the tentacles. Minute spindles also extend from the dorsal surfaces diagonally to the pinnule bases.

Spicules. The most characteristic forms are remarkable Blattkeulen which consist of a tuberculate base from which project a number of parallel flattened finger-like points. Or they may be likened to a plate which has been shattered by several vertical fissures. There is complete intergradation between these Blattkeulen and typical Stachelkeulen, so that it is hard to differentiate them. Besides these curious forms there are regular spindles often curved, from the polyps, and clubs, besides a great variety of nondescript forms.

Color. The colony is a rather dull yellowish brown. The spicules are colorless.

3. *Mopsella spongiosa* new species. (Plate VIII, figs. 1, 1*a*, Plate XII, fig. 7).

Stat. 273. Anchorage off Pulu Jedan, East coast of Aru Islands (Pearl Banks). 13 meters. Sand and shells.

Colony strictly flabellate and reticulate, spongy in texture and not so delicately branched as in the other species, although the meshes are fine. Height of colony 21.5 cm. Spread 20 cm. The main stem is irregular in section, but not appreciably flattened, and is 14 mm. in diameter. About 18 mm. from its base it breaks up into numerous branches which redivide to make the mesh. In the main stem the nodes and internodes are hardly distinguishable. In one of the main branches the proximal node is 7.5 mm. long and 5 mm. in diameter, while the proximal internode is 2.3 mm. long and 3 mm. in diameter. The nodes are much swollen and longer than the internodes throughout the basal parts of the colony. A node near the edge of the fan is 4 mm. long, while the internode just below it is 11 mm. long and 1.6 mm. in diameter. Most of the branches are somewhat flattened, but the distal twigs are round. The meshes are small, usually oblong, and the anastomoses are usually, but not always, at the nodes. The calyces are emplanted very thickly on these sides of the main branches and on all sides of the distal ones.

Spicules. The most typical form of spicule in this species is the foliaceous club, with an irregular densely tuberculate basal part and a distal portion consisting of several flattened expansions usually extending parallel to each other and often in the same plane. Frequently these take the form of coarsely tuberculate spindles from one side of which the foliaceous expansions arise, making "unilateral" spindles. These Blattkeulen are exceedingly varied in

form. There are also many spindles, some with irregular verrucæ, and others with verrucæ in regular whorls. Bent spindles are found in the polyps.

Color. The colony is a very dull grayish brown, like that of many sponges. The axis is dull crimson and the polyps are colored like the cœnenchyma.

Genus **Wrightella** Gray.

Wrightella Gray. Catalogue of the Lithophytes in the British Museum, 1870, p. 31.
Wrightella Ridley. Zoological collections of H. M. S. Alert, 1884, p. 580.
Wrightella Studer. Versuch eines Systemes der Alcyonaria, 1887, p. 32.
Wrightella Wright and Studer. Challenger Reports, the Alcyonaria, 1889, p. XXXVI.
Wrightella Kükenthal. Die Gorgonidenfamilie der Melitodidæ, Zoolog. Anz. Bd. XXXIII, 1908, p. 200.
Wrightella Thomson and Mackinnon. Alcyonarians collected on the Percy Sladen Trust Expedition, Part II, 1910, p. 199.

The earliest definition of this genus at present at hand is that of STUDER (1887) which is as follows:

"Comprimirte Äste und Zweige, die vorragenden Polypenkelche vorwiegend an den Seiten. In der Rinde Blattkeulen. Keine Nährkanale in der Axe".

WRIGHT and STUDER (1889) simply give a translation of the above definition.

KÜKENTHAL (1908) defines the genus as indicated in the following translation:

"Colonies flabellate. Branches flattened and arising from the nodes. No water-vascular canals in the axis. In the outer cortex there are small spherical spicules which are derived from foliaceous clubs. The polyps are lateral or on one surface".

THOMSON and MACKINNON (1910) say that *Wrightella* is characterized by distinctive spicules: "short clubs with very broad flanges. The heads of these clubs form a compact pavement in the cœnenchyma, producing an almost roe-like appearance, as in species of Bebryce".

The type species of this genus is *Wrightella coccinea* Gray. Other species are *Wrightella variabilis* Thomson and Henderson, *W. tongaensis* Kükth. and the new species in the Siboga collection.

1. *Wrightella coccinea* Gray.

? *Isis cocinnea* Ellis and Solander. Natural History of Zoophytes, 1786, p. 107.
? *Isis coccinea* Esper. Pflanzenthiere, I, 1781, p. 280.
Melitæa de Risso Lamouroux. Histoire Polypiers coralligènes flexibles, 1816, p. 463.
Melitæa coccinea Lamarck. Histoire Naturelle des Animaux sans Vertèbres, 2nd Edit., Vol. II, 1836, p. 473.
Wrightella coccinea Gray. Catalogue of the Lithophytes in the British Museum, 1870, p. 32.
Wrightella coccinnea Ridley. Zoological collections of H. M. S. "Alert", 1884, p. 581.
Wrightella coccinea Hickson. Alcyonaria of the Cape of Good Hope, II, 1904, p. 219.
Wrightella coccinea Thomson and Mackinnon. Alcyonarians collected on the Percy Sladen Trust Expedition, Part II, 1910, p. 200.

Stat. 117. 1° 0'.5 N., 122° 56' E. 80 meters. Sand and coral.

Colony (incomplete) flabellate and reticulate, 12.5 cm. long. Main stem, to first branch,

3 cm. long. Second horny node 4.5 mm. broad and 4 mm. long. Calcareous internodes 2.1 mm. broad and 4.5 mm. long. The nodes grow proportionally shorter and the internodes longer until on the distal parts of the colony the former are but 2 mm. long and the latter reach a length of 16 mm. The stem forks at the 5th node. The branches are somewhat compressed laterally. The branching is partly dichotomous and partly alternate, all branches springing from the horny joints and anastomosing through the joining of the ultimate twigs. The calyces are on three sides of the colony, except on the distal twigs where they are on all sides. These latter are quite slender, being but little over 1 mm. in diameter.

The individual calyces are low domes when the polyps are retracted and truncated cones when they are partly expanded. They are rather regularly spaced, more so on the sides than on the front of the colony. A typical calyx measures .6 mm. in height and 1.1 mm. in diameter. The calyx walls, as well as the general cœnenchyma, are packed with foliaceous clubs or Blattkeulen which appear when in situ and viewed under a low magnification as rounded bodies or nodules, because they are thus seen "end on", in the calyx walls, the foliaceous ends being directed upward and outward. The polyps are heavily spiculated, with a strong collaret of bent tuberculate spicules. Above these each tentacle base is provided with two spicules whose ends meet at a wide angle forming an upward directed point. The dorsal surfaces of the tentacles are covered with longitudinal tuberculate spindles.

Spicules. The surface of the cœnenchyma is packed with vertically placed typical Blattkeulen with their foliaceous ends directed outward. These spicules are very characteristic of the genus *Wrightella*, consisting of a basal, irregular, often much branched and tuberculate portion, and a distal part composed of foliaceous expansions gathered together into a globular "head" resembling the bud of a tulip or rose and forming what appears to be a rounded nodule when the spicules are viewed in situ under low magnification. Other Blattkeulen are seen with wide foliaceous expansions which are flattened and longitudinally shattered or split. These are often seen in the distal parts of the calyx walls. Curved, tuberculate spindles are found in the polyps and tentacles.

Color. The colony is almost a brick red, or light scarlet. The polyps are yellow and the axis deep crimson.

General distribution. The type locality seems to be the coast of Mauritius (Ellis and Solander). It has also been reported from the Seychelles, 4—12 fathoms (Gray); from the Indian Ocean, Farquaar Atoll, Prashu, Seychelles (Thomson and Mackinnon), and from the Cape of Good Hope (Ridley).

2. ? *Wrightella tongaensis* Kükenthal.

Wrightella tongaensis Kükenthal. Die Gorgonidenfamilie der Melitodidæ, Zoolog. Anz. Bd. XXXIII, 1908, p. 200.

Stat. 240. Banda Anchorage. 9 to 45 meters. Black sand, coral.
Stat. 258. Tual Anchorage, Kei Islands. 22 meters. Lithothamnion, sand and coral.
Stat. 282. 8° 25′.2 S., 127° 18′.4 E. 27 to 54 meters. Sand, coral and Lithothamnion.

Colony subflabellate, not truly reticulate, although there are occasional anastomoses,

very profusely branched, forming a flattened clump. Height 11.2 cm., spread 12 cm. The basal part is lacking, the proximal node of the stem is 9 mm. in diameter and the only remaining internode is flattened and has a cross section of 8 mm. × 5 mm. and a length of 6 mm. This internode, however, appears to be really two coalesced internodes which have branched from the preceding node and adhere throughout their length. As is usual the nodes decrease in length while the internodes increase from the proximal to the distal parts of the colony until the nodes are but 2 mm. in length while the internodes are sometimes as much as 18 mm. long. The branching is irregularly dichotomous and the branches are round in section, the distal twigs being but 1 mm. in diameter. The calyces are thickly emplanted on three sides of the stem and branches, leaving the posterior face of the colony conspicuously bare.

The individual calyces are dome-shaped verrucæ when the polyps are completely retracted and truncated cones when they are expanded. They are rendered very conspicuous by the fact that the upper parts of their walls are rich carmine while the lower parts of the walls and general cœnenchyma of the branches are orange yellow. A typical calyx is .8 mm. high and 1.3 mm. in diameter. The polyps are heavily spiculated with a collaret composed of three or four rows of strong tuberculate spindles above which a pair on each tentacle base form a point by the meeting of their distal ends. Above these points each tentacle bears a triangular area of spicules, some of which are Stachelplatten with jagged projections. All of these spicules are brilliant red, in sharp contrast with the white of the tentacles themselves.

Spicules. These are exceedingly various, the most characteristic being Blattkeulen, small in size, with their folia compressed into a knob or ball resembling a closed bud. These are superficial on the calyces and general cœnenchyma. Besides these there are a number of ordinary spindles, clubs, bent spindles and variously branched forms, with occasional unilateral spindles and Stachelplatten.

Color. The colony is a brilliant orange with the marginal areas of the calyces, polyp spicules and axis bright crimson. The polyps are white. This is one of the most strikingly colored forms that I have seen among the Melitodidæ.

General distribution. The type locality of this species is Tonga Islands (KÜKENTHAL).

Genus **Parisis** Verrill.

Parisis Verrill. Bulletin Museum of Comparative Zoology, 1864, p. 67.
Parisis (in part) Gray. Catalogue of the Lithophytes in the British Museum, 1870, p. 13.
Parisis Ridley. Annals and Magazine of Natural History, 5th series, Vol. X, 1882, p. 130.
Parisis Studer. Versuch eines Systemes der Alcyonaria, 1887, p. 32.
Parisis Wright and Studer. Challenger Report, the Alcyonaria, 1889, p. 181.
Parisis Delage et Hérouard. Traité de Zoologie Concrète, II, 2, 1901, p. 414.
Parisis Kükenthal. Die Gorgonidenfamilie der Melitodidæ, Zoolog. Anz. Bd. XXXIII, 1908, p. 190.

The original definition for this genus is not at hand.

RIDLEY (1882) says that *Parisis* differs from *Trinella* Gray in having spicular verrucæ.

STUDER (1887) defines the genus as shown in the following translation:

"Branches differ from all other Melitodidæ in springing from the calcareous joints. The

exserted calyces are borne on the outer periphery of the thinner branches. The spicules resemble those of *Isis*, being thick, irregular, often with a median constriction and beset with verrucæ".

This writer says that *Trinella swinhoei* Gray is really the axis of a *Parisis* overgrown by a sponge and bearing *Polythoa* which GRAY mistook for the polyps of his *Trinella*.

The type of this genus is *Parisis fruticosa* Verrill. The only other known species is *P. minor* Wright and Studer.

WRIGHT and STUDER regard *Parisis mauritiensis* Ridley as a synonym for *P. fruticosa*, and THOMSON and SIMPSON conclude that *P. indica* Thomson and Henderson should also be relagated to the same well-known form.

1. *Parisis fruticosa* Verrill.

Parisis fruticosa Verrill. Bulletin Museum of Comparative Zoology, I, 1865, p. 23.
? *Trinella swinhoei* Gray. Catalogue of Lithophytes in the British Museum, 1870, p. 12.
Parisis mauritiensis Ridley. Annals and Magazine of Natural History, 5th series, Vol. X, 1882, p. 131.
Parisis fruticosa Wright and Studer. Challenger Reports, the Alcyonaria, 1889, p. 182.
Parisis indica Thomson and Henderson. Alcyonarians of the Indian Ocean, I, 1906, p. 23.
Parisis fruticosa Thomson and Simpson. Alcyonaria of the Indian Ocean, II, 1909, p. 176.

Stat. 204. 4° 20′ S., 122° 58′ E. From 75 to 94 meters. Sand with dead shells.
Stat. 260. 5° 36′.5 S., 132° 55′.2 E. 90 meters. Sand, coral and shells.
Stat. 274. 5° 28′.2 S., 134° 53′.9 E. 57 meters. Sand and shells. Stones.

Colony subflabellate in form, 46.5 cm. in height, with a spread of about 15 cm., and extensively encrusted with a sponge. The base of attachment is lacking. The stem and all branches are round, the former being 7 mm. in diameter and 5.5 cm. long to first branch. The calcareous and horny segments are equal in diameter and not externally evident, except in the stem and larger branches. The nodes vary from 4 mm. (proximal) to less than 1 mm. (distal) in length. The calcareous internodes are more constant in the sense that their extreme variation is less, but do not increase as regularly from proximal to distal parts of the colony as in many species of this family. They vary from 2 to 6 mm. in length. The main stem gives off a number of small irregular lateral branches, four of which are compound, from its proximal 10 cm., and the stem bends outward and then upward. It then forks into two unequal parts and each of these gives off numerous lateral branchlets both simple and compound, some of which rebranch until branchings of the 6th order are attained. The ultimate twigs are about 1.3 mm. in diameter, measured between the calyces. These latter are rather thickly distributed on all sides of the distal branchlets, but usually they are on but three sides of the branches and on some they are strictly lateral.

The individual calyces are dome-shaped. but tilted so that their summits are inclined toward the distal ends of the branches. A typical one measures 1.4 mm. high and 1.2 mm. in diameter near its base. The calyx walls are filled with a neatly fitted mosaic of polygonal spicules whose edges form close joints and do not seem to overlap. The polyps are very minute, and their attachment to the inside of the calyx, when strongly contracted, is so firm that satisfactory investigation is very difficult. They are either devoid of spicules or very feebly spiculated.

Spicules. These are heavy plate-like forms of various shapes, but usually polygonal. Their surfaces are covered with heavy rounded verrucæ so thickly compacted as to be often contiguous. Some of the smaller ones are radiate, stellate or cruciform. The larger ones sometimes attain a length of .6 mm.

Color. The specimen is a dull purplish or purplish brown, due largely to the presence of the sponge. The nodes are dark brown and the internodes ivory white. The spicules are colorless.

A few fragmentary specimens from station 310 are free from the sponge growth. They are partly creamy white and partly pinkish. In one fragment the axis is a deep rose color, and the polyps seem to be of the same color.

General distribution. The type locality for this species is Soolo Sea. It has also been reported from Mauritius, Banda Sea, Australia, Formosa and the Indian Ocean.

2. ? *Parisis minor* Wright and Studer.

Parisis minor Wright and Studer. Challenger Reports, the Alcyonaria, 1889, p. 1884.

Stat. 139. 0° 11′ S., 127° 25′ E. 397 meters. Mud, stone and coral.

A single specimen, representing the terminal part of a colony is referred with doubt to this species. The fragment is 3.7 cm. long, and was broken off from the colony just below a node which is incomplete and bears on its distal end a bifurcated internode. One of the resultant branches bears a lateral branchlet on its proximal internode and bifurcates 1.5 mm. from its proximal end, or at the end of the first internode. One of the resultant branchlets is a mere stub. The other is 2.5 cm. long and has adhering to it a piece of a branchlet from a missing branch. The other main branch bifurcates twice, the furcations being Y-shaped rather than U-shaped. Its distal internode is longest, measuring 17 mm. The calyces are nearly all lateral, but a few are on the anterior face of the colony.

The individual calyces are in the form of truncated cones, a typical one measuring .8 mm. in height and 1.5 mm. in diameter at the base. The calyx walls are filled with coarse, heavily tuberculate spindles which are exceedingly irregular in arrangement. Sometimes they are disposed horizontally and at other times those around the margin are vertical, forming a rude series of irregular jagged points. The polyps are very heavily spiculated, with a relatively narrow collaret above which a group of heavy spindles are placed almost vertically at each tentacle base, forming a series of eight points. The polyps are retracted to their collarets and the infolded tentacles form a conical mass which completes the cone-shape of the calyx.

Spicules. These are heavy spindles with short branched verrucæ not in whorls. They are not so large as in *P. fruticosa* and their branching is much more evident. A number of more slender thorny spindles are found in the polyps. Although not so regular in form as represented by Wright and Studer's figures, they agree with them fairly well in essential features.

Color. The specimen described is grayish white in color.

General distribution. The type locality for this species is Hyalonema grounds, Japan 345 fath.

Genus **Birotulata** new genus.

Colony flabellate. Both nodes and internodes traversed by water-vascular canals. The branches are all borne on the nodes. Characteristic spicules double wheels.

Type species, *Birotulata splendens* Nutting.

1. *Birotulata splendens* new species. (Plate X, figs. 1, 1*a*, 2; Plate XII, fig. 8).

Stat. 258. Tual Anchorage, Kei Islands. 22 meters. Lithothamnion, sand and coral.

The type was originally a very large colony, but has been broken into many fragments. The specimen was flabellate in form and not reticulate and probably originally measured as much as 1 meter in height. The trunk and main branches are laterally compressed, the former being 2.8 cm. × 1.9 cm. in section, and the latter as much as 2.8 cm. × 2.2 cm. in section. The main stem bifurcates 7 cm. from its proximal end into two very unequal branches. The larger of these, after giving off four branchlets, the stubs of which remain, bifurcates into two branchlets which are approximately round in section, the larger one having a diameter of 2 cm. Some of the more distal branchlets are round and others slightly compressed laterally. The branching is in part dichotomous and in part lateral, the former prevailing in the distal parts of the colony, the ultimate branchlets being 1.5 mm. in diameter. The furcations are usually U-shaped rather than Y-shaped. The calyces are on the sides and front of the colony, leaving a bare posterior space, sharply distinguished by its bright chrome yellow color, as if the colony were crudely painted scarlet on front and sides and yellow behind.

The individual calyces are closely set and have each a broad border of scarlet which gives the red color to the branches. They are almost entirely included and very small, not being over .5 mm. in diameter on the average. Their walls, like the general cœnenchyma, are filled with small smooth double-wheels. The polyps are retractile, and bear a collaret which is rather strong and composed of two or three rows of transverse red spindles. Above these a few spindles are arranged en chevron on each tentacle base, and beyond this the spindles are longitudinal. The nodes are not indicated superficially on the main stem and larger branches, and are nowhere so conspicuous as in *Melitodes ochracea*. The internodes, as well as the nodes, are penetrated by numerous water-vascular canals.

Spicules. The most conspicuous and numerous forms are the double-wheels characteristic of the genus. These are on the surface and also constitute the chief element in the cœnenchyma. They look much like two buns pressed together, sometimes unsymmetrically. Some of them have a small nodule at each end in addition to the two wheels. There are also densely tuberculate short stout spindles, and ordinary spindles, mostly from the polyps, and numerous irregular forms which are usually minute. The spicules of the axis are smooth bar-like and needle-like forms.

Color. The colony is scarlet and chrome yellow, the posterior face of the distal parts of the colony being sharply differentiated, as if painted with vivid yellow. The yellow shows

also on the other sides between the scarlet borders of the calyces. The polyp spicules are scarlet. The axis is a bright yellow, a characteristic which differentiates this species from *Melitodes ochracea*. The stem and main branches are dark red. Another colony has the distal internodes creamy white and the nodes yellow.

This species bears a very close superficial resemblance to *Melitodes ochracea*.

THOMSON and MACKINNON[1] have called attention to two other cases of very close approximation of species belonging to separate genera, i. e., *Wrightella coccinea* and *Melitodes coccinea* (Esper); also *Wrightella variabilis* Thomson and Henderson and *Melitodes variabilis* Hickson. The present case is quite similar to those noted by these writers.

There is very close resemblance between *Birotulata splendens* and *Melitodes ochracea*, but the spiculation is so different as to justify a generic distinction between the two.

[1] Alcyonarians collected by the Percy Sladen Trust Expedition. Part II, 1910, p. 200.

DISTRIBUTION OF THE MELITODIDÆ COLLECTED BY THE SIBOGA EXPEDITION

List of Stations

at which Melitodidæ were collected by the Siboga Expedition
and a List of Species collected at each Station.

STATION 33. Bay of Pidjot, Lombok. 22 meters, and less. Mud, coral and coral sand. *Melitodes esperi.*

STATION 50. Bay of Badjo, West coast of Flores. Up to 40 meters. Mud, sand and shells. *Melitodes esperi.*

STATION 53. Bay of Nangamessi, Sumbu. Up to 36 meters. Coral sand, mud near shore. *Mopsella clavigera.*

STATION 60. Haingsisi, Samau Island near Timor. 23 meters. Lithothamnion in 3 meters and less. Reef. *Melitodes variabilis, M. esperi, Acabaria hicksoni.*

STATION 71. Makassar and surroundings. Up to 32 meters. Mud, sand with mud, coral. *Melitodes ochracea, Mopsella studeri.*

STATION 80. 2° 25′ S., 117° 43′ E. 50 to 40 meters. Fine coral sand. *Melitodes esperi.*

STATION 85. 0° 36′.5 S., 119° 29′.5 E. 724 meters. Fine grey mud. *Melitodes ochracea.*

STATION 117. 1° 0′.5 N., 122° 56′ E. 80 meters. Sand and coral. *Acabaria tenuis, Wrightella coccinea.*

STATION 139. 0° 11′ S., 127° 25′ E. 397 meters. Mud, stones and coral. *Parisis minor.*

STATION 144. Anchorage north of Salomakieë (Damar) Island. Coral bottom and Lithothamnion. *Melitodes esperi, Acabaria tenuis.*

STATION 164. 1° 42′.5 E. 130° 47′.5 E. 32 meters. Sand, small stones and shells. *Melitodes flabellum, M. esperi, M. modesta.*

STATION 204. 4° 20′ S., 122° 58′ E. 75 to 94 meters. Sand with dead shells. *Parisis fruticosa.*

STATION 234. Nalahia Bay, Nusa-Laut Island. 46 meters. Stony. *Melitodes ochracea.*

STATION 240. Banda Anchorage. 9 to 45 meters. Black sand, coral. Lithothamnion. *Acabaria formosa, Wrightella tongaensis.*

STATION 244. 4° 25′.7 S., 130° 3′.7 E. 2991 meters. Fine bluish green mud. *Mopsella studeri.*

STATION 257. In Duroa Strait, Kei Islands. Up to 52 meters. Coral. *Melitodes esperi.*

STATION 258. Tual Anchorage, Kei Islands. 22 meters. Lithothamnion, sand and coral. *Wrightella tongaensis, Birotulata splendens.*

STATION 260. 5° 36′.5 S., 132° 55′.2 E. 90 meters. Sand, coral and shells. *Acabaria triangulata, Parisis fruticosa.*

STATION 261. Elat, West coast of Great Kei Islands. 27 meters. Mud. *Melitodes flabellum.*

STATION 273. Anchorage off Pulu Jedan, East coast of Aru Islands. 13 meters. Sand and shells. *Melitodes flabellum, M. esperi, M. modesta, Mopsella studeri, M. spongiosa.*

STATION 274. 5° 28′.2 S., 134° 53′.9 E. 57 meters. Sand and shells, stones. *Melitodes variabilis, M. modesta, Acabaria triangulata, Mopsella studeri, Parisis fruticosa.*

STATION 282. 8° 25′.2 S., 127° 18′.4 E. 27 to 54 meters. Sand, coral and Lithothamnion. *Wrightella tongaensis.*

STATION 299. 10° 52′.4 S., 123° 1′.1 E. 34 meters. Mud, coral and Lithothamnion. *Melitodes flabellum, M. squamata.*

STATION 305. Mid channel in Solor Strait, Off Kampong Menanga. 113 meters. Stony. *Melitodes flabellum.*

STATION 310. 8° 30′ S., 119° 7′.5 E. 73 meters. Sand with few pieces of dead coral. *Melitodes flabellum, Acabaria philippinensis, Parisis fruticosa.*

STATION 315. Anchorage East of Sailus Besar, Paternoster Islands. Up to 36 meters. Coral and Lithothamnion. *Melitodes esperi.*

The above list shows that Melitodidæ were collected at 26 stations, or at about 13% of the stations at which successful hauls were made during the Siboga Expedition. The most abundant genus of Melitodidæ in the region covered by the expedition is the type genus *Melitodes*, which was collected at 17 stations out of the 26. *Melitodes esperi* seems to be the most abundant species of Melitodidæ in the collection, having been collected at 9 stations; and *M. flabellum* is the next.

Table showing the bathymetric and geographic distribution of the Scleraxonia of the Siboga Expedition.

	BATHYMETRIC.					GEOGRAPHIC, ASIDE FROM DUTCH EAST INDIES.
	1 to 50 meters	50 to 100 meters	100 to 200 meters	200 to 500 meters	Over 500 meters	
BRIAREIDÆ.						
Solenocaulon sterroklonium	*	*	.	.	.	Indian Ocean.
Solenocaulon grayi	*	*	.	.	.	Australia, Indian Ocean.
Solenocaulon querciformis	*	.	.	.	*	
Solenocaulon jedanensis	*	.	.	.	.	
Titanidium friabilis	*	.	.	.	.	
Semperina rubra	*	.	.	.	.	Bohol, Philippine Islands.
Semperina brunnea	*	.	.	.	.	North of New Zealand.
Suberia köllikeri	.	*	.	.	*	
Suberia excavata	*	.	.	.	.	
Suberia macrocalyx	.	.	.	.	*	
Paragorgia splendens	.	.	.	.	*	
Iciligorgia orientalis	*	.	.	.	.	Indian Ocean.
SCLEROGORGIDÆ.						
Suberogorgia verriculata	*	.	.	.	*	Northwest coast of Australia, Japan.
Suberogorgia ornata	*	.	.	*	.	Indian Ocean.
Suberogorgia köllikeri	*	*	.	.	*	Japan, Ceylon, Indian Ocean.
Suberogorgia rubra	*	*	.	.	.	Ceylon.
Suberogorgia appressa	*	.	.	.	.	
Suberogorgia thomsoni	.	*	.	.	.	
Suberogorgia pulchra	*	.	.	.	.	
Korœides koreni	.	*	.	.	*	Japan, Indian Ocean.

	BATHYMETRIC.					GEOGRAPHIC, ASIDE FROM DUTCH EAST INDIES.
	1 to 50 meters	50 to 100 meters	100 to 200 meters	200 to 500 meters	Over 500 meters	
MELITODIDÆ.						
Melitodes ochracea	*	.	.	.	*	Indian Ocean.
Melitodes flabellum	*	*	*	.	.	Indian Ocean.
Melitodes variabilis	*	*	.	.	.	Indian Ocean.
Melitodes esperi	*	*	.	.	.	Indian Ocean.
Melitodes squamata	*	.	.	.	.	
Melitodes modesta	*	*	.	.	.	
Acabaria philippinensis	.	*	.	.	.	Indian Ocean.
Acabaria tenuis	*	*	.	*	*	Japan.
Acabaria formosa	*	.	.	.	.	
Acabaria hicksoni	*	.	.	.	.	
Acabaria triangulata	.	*	.	.	.	
Mopsella clavigera	*	.	.	.	.	Indian Ocean.
Mopsella studeri	*	*	.	.	.	
Mopsella spongiosa	*	.	.	.	.	
Wrightella coccinea	.	*	.	.	.	Indian Ocean (Mauritius), Cape of Good Hope.
Wrightella tongaensis	*	*	.	.	.	Tonga Islands. (South Pacific).
Parisis fruticosa	.	*	.	.	.	Sooloo Sea, Indian Ocean, Australia.
Parisis minor	.	.	.	.	*	Hyalonema Grounds (Japan).
Birotulata splendens	*	.	.	.	.	

This table clearly indicates that the Scleraxonia are essentially Indo-Pacific in distribution, but five species being found so far north as Japan, four extending south to Australia and one to the Tonga Islands. *Wrightella coccinea* strays as far from the type locality as the Cape of Good Hope. Fourteen of the twenty one hitherto described species are found in the Indian Ocean, which seems the centre of distribution for the group, and not a single species is surely known to occur in the Atlantic Ocean.

In bathymetric distribution this suborder is mainly from shallow water, thirty six of the thirty nine species in the collection being found at less depths than 100 meters, and but ten species reaching a depth of over 500 meters. It is a remarkable fact that eight of the ten species referred to are also found at depths of less than 100 fathoms. The paucity of forms found between 100 and 500 meters is doubtless mainly accidental, as it is reasonable to suppose that the eight species found at less than 100 meters and over 500 meters really occur at intermediate depths.

The deepest dredging at which a species of this suborder was secured in 2264—1165 meters, where *Suberia macrocalyx* was taken. Next to this comes *Solenocaulon querciformis* from a depth of 828 meters. But the identification of this specimen is somewhat doubtful.

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EXPLANATION OF PLATES

The photographs were made from nature by the author.
The spicules were drawn under the camera lucida by Mr. DAYTON STONER.

PLATE I.

Fig. 1. *Solenocaulon querciformis* n. sp. Natural size. 1*a*, part of twig × 5.

PLATE II.

Fig. 1. *Solenocaulon jedanensis* n. sp. Natural size. 1*a*, part of twig × 5.
Fig. 2. *Semperina brunnea* n. sp. Natural size. 2*a*, part of twig × 5.

1
2
1a
2a

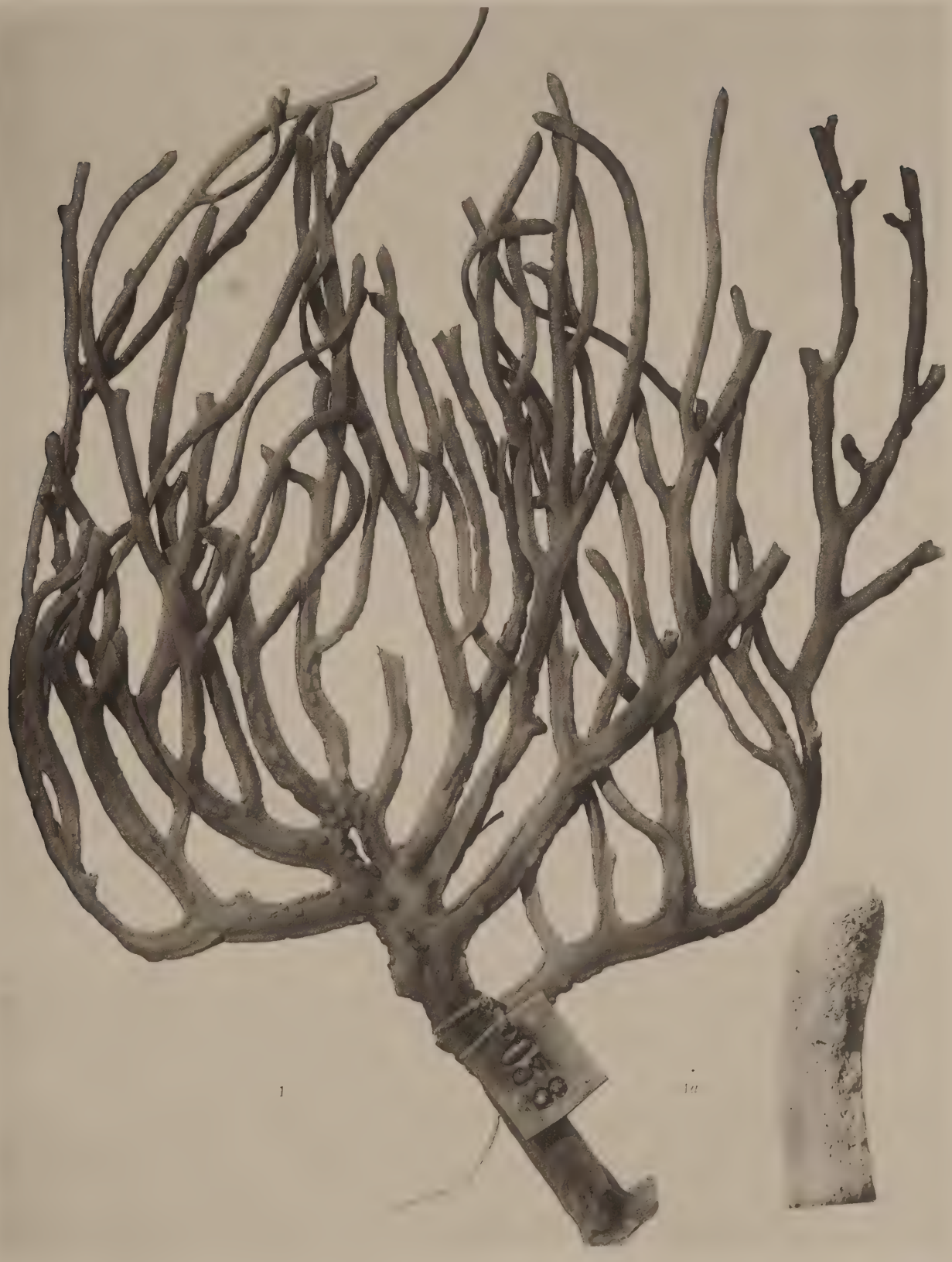
PLATE III.

Fig. 1. *Titanidium friabilis* n. sp. Natural size. 1*a*, part of twig × 5.
Fig. 2. *Suberia excavata* n. sp. Natural size. 2*a*, part of branch × 5.
Fig. 3. *Suberia macrocalyx* n. sp. Natural size. 3*a*, part of branch × 5.
Fig. 4. *Paragorgia splendens* n. sp. Natural size. 4*a*, part of branch × 5.

1
1a
3a
3
2
2a
4a
4

PLATE IV.

Fig. 1. *Iciligorgia orientalis* Ridley. Natural size. 1*a*, part of twig × 5.



1 1a

PLATE V.

Fig. 1. *Suberogorgia appressa* n. sp. Natural size. 1*a*, tip of branch × 5.

1a
1

PLATE VI.

Fig. 1. *Suberogorgia pulchra* n. sp. Natural size. 1*a*, part of branch × 5.
Fig. 2. *Suberogorgia thomsoni* n. sp. Natural size. 2*a*, tip of twig × 5.
Fig. 3. *Korœides koreni* Wright and Studer. Natural size. 3*a*, tip of branch × 5.

1
1a
2
2a
3
3a

PLATE VII.

Fig. 1. *Melitodes squamata* n. sp. Natural size. 1*a*, part of branch × 5.
Fig. 2. *Melitodes modesta* n. sp. Natural size. 2*a*, part of twig × 5.
Fig. 3. *Acabaria formosa* n. sp. Natural size. 3*a*, part of branch × 5.

3
3a
2
2a
1a
1

PLATE VIII.

Fig. 1. *Mopsella spongiosa* n. sp. Natural size. 1*a*, tip of branch × 5.
Fig. 2. *Acabaria triangulata* n. sp. Natural size. 2*a*, tip of branch × 5.
Fig. 3. *Acabaria hicksoni* n. sp. Natural size. 3*a*, tip of branch × 5.

1
2
1a
2a
3
3a

PLATE IX.

Fig. 1. *Mopsella studeri* n. sp. Natural size. 1*a*, part of branch × 5.

1a
1

PLATE X.

Fig. 1. *Birotulata splendens* n. sp. Natural size. 1*a*, part of branch × 5.
Fig. 2. *Birotulata splendens* n. sp. Another branch, natural size.

1
1a
2

PLATE XI.

Fig. 1. *Solenocaulon querciformis* n. sp. *a*, *b* and *c*, spicules from the cœnenchyma; *d* and *e*, spicules from the axis. *a* × 100; the others × 88.

Fig. 2. *Solenocaulon jedanensis* n. sp. *a*, spicule from the axis; *b* and *c*, forms from the inner walls of calyces; *d*, from the cœnenchyma. All × 120.

Fig. 3. *Semperina brunnea* n. sp. *a* and *b*, spicules from the axis; the others from the cœnenchyma. All × 120.

Fig. 4. *Suberia excavata* n. sp. *a*, spicule from the axis; *b*, a Y-shaped form from the cœnenchyma. Both × 120.

Fig. 5. *Suberia macrocalyx* n. sp. *a*, *b* and *c*, spicules from the cœnenchyma; × 88.

Fig. 6. *Titanidium friabilis* n. sp. *a* and *c*, spicules from the cœnenchyma; *d*, an intermediate form; *b*, a spicule from the axis. All × 120.

Fig. 7. *Suberogorgia appressa* n. sp. *a* and *b*, spicules from the cœnenchyma, *c*, an axis spicule. All × 250.

Fig. 8. *Suberogorgia thomsoni* n. sp. *e*, an axis spicule; *a*, *b*, *c* and *d*, forms found in the cœnenchyma.

Fig. 9. *Suberogorgia pulchra* n. sp. *a* and *g*, fragments of the spicular mesh of the axis; *b*, *c*, *e* and *f*, oval forms from the cœnenchyma; *d*, rod-shaped form.

D. Stoner del.

PLATE XII.

Fig. 1. *Melitodes squamata* n. sp. *a*, bent tuberculate spindle from polyp; *b*, *c*, *d* and *e*, spicules from the cœnenchyma. All × 250.

Fig. 2. *Melitodes modesta* n. sp. *a* and *b*, spindles from the cœnenchyma; *c*, one-sided spicule from cœnenchyma. All × 250.

Fig. 3. *Acabaria formosa* n. sp. *a*, *b*, *c* and *f*, bent spindles; *d*, spiny club; *e*, short, stout form. All × 250.

Fig. 4. *Acabaria hicksoni* n. sp. *a*, *b* and *c*, heavy bent spindles; *d* and *e*, irregular forms. *a* and *e* × 120; the rest × 250.

Fig. 5. *Acabaria triangulata* n. sp. *a*, triangular form; *b*, irregular spindle; *c*, club-shaped form. All × 120.

Fig. 6. *Mopsella studeri* n. sp. *a*, *b* and *c*, characteristic Blattkeulen with foliaceous projections; *d*, bent, irregular spindle. All × 250.

Fig. 7. *Mopsella spongiosa* n. sp. *a*, bent spindle; *b* and *f*, foliaceous clubs; *c*, irregular spindle; *d*, characteristic Blattkeule. All × 250.

Fig. 8. *Birotulata splendens* n. sp. *a*, bent spindle from polyp; *b*, a combination form; *d* and *e*, short spindles; *c*, *f*, *g*, characteristic double wheels. All × 250.

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